

Contract Documents

Combe Fill South Landfill Superfund Site Remedial Construction

Volume 2A Technical Specifications

New Jersey Department of
Environmental Protection

August 1991



O'BRIEN & GERE

511168



TECHNICAL SPECIFICATIONS

COMBE FILL SOUTH LANDFILL

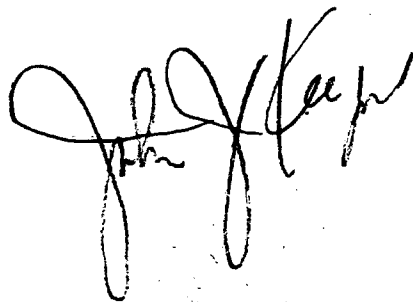
SUPERFUND SITE

REMEDIAL CONSTRUCTION

PREPARED FOR:

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

AUGUST 1991

A handwritten signature in black ink, appearing to read "John J. Keane". The signature is stylized with large loops and a long horizontal stroke at the end.

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SUMMARY OF WORK

PART 1 - BACKGROUND

1.01 SITE DESCRIPTION

- A. The Combe Fill South Landfill is located north of Parker Road in Chester and Washington Townships, Morris County, New Jersey. The inactive landfill consists of three separate disposal areas covering approximately sixty-five (65) acres. Land use in the vicinity of the landfill consists primarily of low-density residential among large parcels of cleared rolling hills. A few commercial establishments and a local nursery school are located on Parker Road near the landfill. A series of county and state run park segments, including those of the Black River County Park and Hacklebarney State Park, lie to the east and south of the site along the Black River. The Combe Fill South Landfill is near the headwaters of Trout Run which flows into Hacklebarney State Park. The aquifer system that underlies and surrounds Combe Fill South Landfill consists of fractured granitic bedrock and an overlying layer of soil and saprolite.

1.02 REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RIFS)

- A. The Combe Fill South landfill accepted municipal and industrial wastes from the 1940s through 1981. Approximately five million cubic yards of waste material are buried within the Combe Fill South Landfill. The majority of the waste includes household waste and non-hazardous industrial waste. The Combe Fill South Landfill site was listed on the National Priority List in September, 1983. Subsequently, a Remedial Investigation/Feasibility Study was conducted from 1984 through 1985 under the direction of the New Jersey Department of Environmental Protection (NJDEP). The RIFS conducted at the site revealed the presence of a wide range of contaminants consistent with the known uses of the site and the variety of wastes accepted. The presence of volatile organics compounds has been identified within both the shallow and deep aquifer at the site. Additionally, contamination has been detected within nearby residential wells.

1.03 RECORD OF DECISION (ROD)

- A. A Record of Decision (ROD) was signed by USEPA on September 29, 1986 and identified the following areas to be encompassed within the Remedial Design:
- An active gas collection and treatment system for methane and any other landfill generated gases;

- Expanded environmental monitoring of water, air, soils, and leachate;
- A multilayered cap that covers the landfilled areas and extends under the utility company right of way;
- Pumping and on-site treatment of shallow ground water discharge to Trout Brook;
- Surface water controls to accommodate runoff from both normal precipitation and severe storms;
- Security fencing, an access road and general site preparation.

1.04 FIELD SAMPLING AND TESTING PROGRAM

A. A field sampling and testing program was conducted to provide additional information for the final design. The field sampling and testing program included the following:

- Excavation of test pits to determine the edge of refuse;
- Installation and sampling of gas test wells to determine the quantity and quality of landfill gases;
- Sampling and testing of on and off-site soils to identify potentially suitable construction materials;
- Installation of pump test wells to determine ground water recovery well yields.

PART 2 - DESCRIPTION OF WORK

2.01 GENERAL DESCRIPTION

A. The Division of Hazardous Site Mitigation, New Jersey Department of Environmental Protection proposes to remediate the site of the Combe Fill South Landfill located on Parker Road in Chester and Washington Townships, Morris County, New Jersey.

The project includes, but is not limited to, the following:

- An engineered landfill cap system to minimize infiltration into the landfill including a cap drainage system incorporating pipe drains within the cap drainage layer, and a vegetative cover;
- A shallow ground water recovery and treatment system;
- An active gas collection and extraction system, gas treatment by flaring and a gas condensate collection and treatment system;
- A site access road and site perimeter road;

- A security fence enclosing the site;
- Ground water monitoring wells both on-site and off-site

The Contractor shall be responsible for providing all analytical services, temporary facilities, and decontamination facilities required for completion of the project.

- B. The Contractor shall furnish all labor, equipment, materials, and equipment required to operate and maintain the closed landfill and associated systems for a 24 month period beginning at the date of substantial completion. This work shall include, but not be limited to:

- Site maintenance, including site access;
- Operation and maintenance of the gas collection and treatment system;
- Maintenance required by the O&M Manual;
- Health and Safety requirements;
- Medical monitoring;
- Power requirements and telephone service;
- Preparation and submittal of reports and records;

The second 12 months are on a month by month basis at the discretion of the State.

2.02 WORK METHODS

- A. Work methods for on-site work are based upon federal, state, and local regulations and engineering analysis.

2.03 DEFINITIONS

- A. The expressions "landfill", "landfill area", and "landfill closure area" shall define the area of refuse over which the cap system is to be constructed and also the areas in which fill/refuse is currently in place.

PART 3 - EXECUTION

3.01 WORK TO BE DONE

- A. The work activities shall include, but are not limited to, the following:
1. Mobilization for performing the work described hereinafter, and demobilization following completion and acceptance of the work;

2. Preparation and implementation of a Health and Safety Plan (HASP) including an Air Monitoring Plan;
3. Preparation and implementation of a Dust Migration Control Plan;
4. Preparation of a Spill and Discharge Control Plan;
5. Preparation of an Environmental Pollution Control Plan;
6. Preparation and implementation of a Construction Water Management Plan;
7. Preparation and implementation of a Site Security Plan
8. Preparation and implementation of a Sedimentation and Erosion Control Plan;
9. Furnishing, installation and operation of an on-site geotechnical laboratory.
10. Preparation of a Contractor Quality Control Plan (CQC) to ensure that all operations performed by the Contractor and all subcontractors are completed in accordance with the contract provisions. Implementation of the Contractor Quality Control Plan will be performed in conjunction with actual work requiring Quality Assurance and Quality Control QA/QC.
11. Clearing and grubbing, including the cleanup and disposal of surface debris at the site;
12. Grouting of existing monitoring wells as specified or directed;
13. Installation of gabion retaining wall;
14. Removal of refuse from outside the final limits of the low permeability cover and placement of the excavated refuse underneath and within the limits of the final limits of the low permeability cover. Relocated refuse is to be covered with a minimum of one foot of embankment material
15. Regrading of refuse within the final low permeability cover to achieve required subgrades. Regraded refuse shall be covered with a minimum of one foot of embankment material following regrading.
16. Excavation, stockpiling and/or movement to fill locations of excess material resulting from construction of drainage ways and channels, and from grading operations;
17. Importation of embankment material required to achieve subgrades.

18. Construction of access road from Parker Road, access road around landfill perimeter, and access road to and parking area in vicinity of the exhauster building and ground water treatment facility. Construction of the site access road must be completed early in the construction sequence since the current access through private property is considered temporary;
19. Furnishing, installation and operation of decontamination facilities;
20. Provide, furnish, and locate Contractor's, Engineer's, and State's field office trailers;
21. Furnishing, operation and maintenance of temporary facilities required for construction activities.
22. Furnish and erect site signs, and dismantle and dispose of the same at the completion of contract;
23. Installation of a 21 inch reinforced concrete culvert parallel to an existing 21 inch concrete culvert on a private residential drive approximately 1,500 feet upstream of Parker Road on the West Branch of Trout Brook;
24. Maintain Parker Road during construction;
25. Construction of a soil barrier layer test section;
26. Installation of soil barrier layer. The soil barrier layer will be constructed of either natural soil with a maximum permeability of 1×10^{-7} centimeters per second (cm/sec) or a bentonite amended soil with a maximum permeability of 1×10^{-7} cm/sec.
27. Import from borrow source, place and compact soil barrier layer having a maximum permeability of 1×10^{-7} centimeters per sec (cm/sec) to a compacted thickness of 24 inches;
28. Installation of geosynthetic filter fabrics.
29. Installation of a low density polyethylene (LDPE) geomembrane with a minimum thickness of 40 mils on portions of the cap with slopes of 10% or less or as otherwise shown on the Contract Drawings;
30. Import from borrow source and place drainage layer material with a minimum permeability of 1×10^{-2} cm/second, including required filter layers, drainage pipes, and associated appurtenances;
31. Import and place a vegetative layer with an installed thickness of 18 inches topped with topsoil with an installed thickness of 6 inches;

32. Fertilize, seed and mulch the topsoil and establish a stand of vegetation;
33. Construction of cap and perimeter drainage system, including detention basins.
34. Installation of gas collection wells within the limits of the low permeability cover;
35. Construction of buried and above ground gas collection piping and associated appurtenances;
36. Installation of gas condensate collection system including all piping, manholes, and accessories;
37. Construction of exhauster building;
38. Installation of gas exhausters and associated appurtenances and equipment;
39. Installation of the enclosed flare and associated appurtenances;
40. Installation of ground water recovery system wells, piping, and accessories;
41. Installation of ground water conveyance piping;
42. Construction of an on-site ground water treatment facility including the following major treatment processes: ground water and landfill gas condensate holding tanks, metals, removal system, sequencing batch reactor biological waste treatment system, filtration, carbon adsorption, sludge conditioning and dewatering, ancillary process pumps and chemical feed system;
43. Start-up, performance testing and placing into service;
44. Installation of on-site and off-site ground water monitoring wells.
45. Perform all specified and necessary testing of soil, air, water and construction materials.
46. Repair of site fence and gates if damaged during construction;
47. Decontamination and removal of all Contractor equipment and Contractor equipment furnished for the use of the engineer and the State during construction;
48. Decontamination and removal of all temporary construction facilities;

- 49. Disconnection of all temporary site utilities and site restoration;
- 50. Transfer of all record drawings and other project related material to the owner;
- 51. Environmental restoration of off-site landfill areas disturbed by construction.

PART 4 - SPECIAL PROJECT PROCEDURES

4.01 SCOPE

- A. The Contractor shall establish the special project procedures as described in Special Project Procedures.

4.02 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall furnish all means necessary for continuous adherence to these procedures during performance of the work.

PART 5 - CONSTRUCTION SEQUENCE

- A. The Contractor may implement construction in any sequence provided the required plans and procedures referenced in this Section and Special Project Procedures are met.

PART 6 - CONTRACTOR'S USE OF SITE

6.01 SCOPE

- A. The Contractor shall have complete and exclusive use of the site for execution of the work, subject to requirements of the USEPA, the State, and their designated representatives.

6.02 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall assume full responsibility for the protection and safekeeping of equipment and materials located on-site until final completion, including operation and maintenance period.

6.03 SITE CONTROL

- A. The Contractor shall be responsible for security at the site.

- END OF SECTION -

SECTION 01015

PAYMENT ITEM DESCRIPTIONS

PART 1 GENERAL

- A. The following is a list and general description of the payment items which will be used to effect payment for the work required by this contract. The basis of measurement and payment is also described for each payment item description. The Contractor shall furnish all materials, labor, and equipment, supervision and all things necessary to accomplish the Items of work.

1. PERFORMANCE AND PAYMENT BONDS

1.1 General: Under this Item, the Contractor shall provide the Performance and Payment Bonds as specified in the General Conditions or other acceptable security as provided for in the Instruction to Bidders.

1.2 Work Included: The work under this Item includes the cost of required Performance and Payment Bonds as specified in the General Conditions, or other acceptable security as provided for in the Instructions to Bidders.

1.3 Payment: The lump sum bid for Item 1 shall constitute the maximum payment for the cost of providing the necessary Performance and Payment Bonds or other securities. This Item shall be bid as a not-to-exceed lump sum. The State will pay the Contractor's actual costs up to the lump sum bid price. When invoicing for this Item the Contractor shall provide to the State supporting documentation (receipts, bills, etc.) to substantiate costs.

2. MOBILIZATION/DEMOBILIZATION

2.1 General: Under this Item the Contractor shall furnish work, materials and operations required for the assembling and setting up for the project at the Combe Fill South Landfill site in Chester and Washington Townships, Morris County, New Jersey, and upon final acceptance of the contract work, the disassembly and removal from the project site of all Contractor owned material, equipment, furnishings, and debris generated during the project construction.

2.2 Work Included: The work under this Item includes all labor, materials, and equipment necessary at the project site, including but not limited to the following:

- a. All costs incurred in initiating the contract, not specifically paid for under other line Items.
- b. Initial movement of personnel and equipment to the project site following award of contract, and any other movement of personnel and/or equipment to or from the project work site prior to final acceptance of the contract work.

- c. Establishment of the Contractor's, Engineer's, and State offices, and removal of same from the project work site upon final acceptance of the contract work.
- d. On-site geotechnical laboratory.
- e. Construction of haul and access roads, storage, staging and parking areas including snow fence, if required. Maintenance of existing roads.
- f. Construction of sanitary and other facilities required by the Specifications and State and local regulations.
- g. Furnishing and erecting the project sign, and its removal and disposal upon final acceptance of the contract work.
- h. Moving on and off-site all construction equipment, hauling units, concrete mixers, hoisting equipment, welding machines, compressors, dewatering pumps, and all tools required to complete the work.
- i. The Contractor shall demolish and remove haul roads, storage and parking areas, including snow fencing, constructed to perform the work under this contract, and any debris resulting from the Contractor's construction activities.
- j. Provision of temporary utilities and controls.

Mobilization shall also include all other work and operations which must be performed prior to beginning of work on compensable Items of work at the project site.

The cost of required insurance and any other initial expense required for the start of work shall be included in this Item.

2.3 Payment: The lump sum price bid for Item 2 shall be payment in full for the work of mobilization/demobilization. Payment will be made in accordance with the following schedule:

- 70% upon completion of mobilization
- 30% upon completion of demobilization

Payment as directed will be full compensation for all labor, materials, tools, equipment, and incidentals required to complete this Item, regardless of the fact that the Contractor may have, for any reason, shut down the work on the project and moved equipment away from the project and then back again.

3. OPERATION AND MAINTENANCE OF TEMPORARY FACILITIES

3.1 General: Under this Item, the Contractor shall furnish work, materials, and operations required for the maintenance of temporary facilities at the project site. This Item also includes the cost of power and utilities for the State's, Engineer's, and Contractor's trailers with the

exception of the monthly cost of telephone service for the State's and Engineer's trailers.

3.2 Work Included: The work under this Item includes all labor, materials, and equipment necessary for the operation and maintenance of temporary facilities necessary at the project site, including, but not limited to:

- a. Temporary electricity and lighting.
- b. Maintenance of temporary telephone service to the site and the service charges for temporary telephone service for the Contractor's use.
- c. Temporary water.
- d. Temporary sanitary facilities.
- e. Operation and Maintenance of the State's, Engineer's and Contractor's trailers and associated furnishings.
- f. Maintenance of vehicles provided by the contractor for the use of the State and Engineer.
- g. Health, safety, and emergency response equipment, including first aid and fire protection equipment.
- h. Access roadways.
- i. Project signs.
- j. Fencing and other barriers.

This Item does not include the operation and maintenance of the on-site geotechnical laboratory.

3.3 Payment: The lump sum bid for Item 3 shall constitute payment in full for the work of operating and maintaining temporary site facilities. Payment will be made in equal monthly installments beginning the month that mobilization is completed. The equal monthly installments shall be based on the time remaining following mobilization, utilizing the contract duration contained in the contract documents.

4. CASH ALLOWANCE FOR TELEPHONE, ELECTRIC AND GAS SERVICES

4.1 General: Under this Item, an allowance is included to pay the appropriate utilities fees required by the utility for installation of services.

4.2 Work Included: Under this Item, the Contractor shall compensate the appropriate utilities for fees associated with utility installation. These include:

- New Jersey Bell for telephone services at the site;

- Jersey Central Power and Light for electric services at the site;
- Jersey Central Power and Light for gas service at the site;

Work required by the Contractor to facilitate utility installation is to be paid under other Items.

4.3 Payment: The State will pay the actual cost, not to exceed the lump sum bid price for each component of Item 4, for fees associated with utility installation at the site. Payment shall be based upon submission of utility invoices along with proof of payment by the Contractor.

5. ON-SITE GEOTECHNICAL TESTING LABORATORY

5.1 General: Under this Item, the Contractor shall furnish work, materials, and operations required for an on-site geotechnical laboratory.

5.2 Work Included: The work under this Item includes the cost for the on-site geotechnical laboratory, including but not limited to laboratory buildings and laboratory equipment.

5.3 Payment: The lump sum price bid for Item 5 shall constitute payment in full for the on-site geotechnical laboratory. Payment shall be made in equal monthly installments beginning the month that the laboratory is mobilized at the project site and ready to operate. The equal monthly payments shall be based on the time remaining following mobilization utilizing the contract duration contained in the contract document. Payment in full will be made when the laboratory is removed, if no longer needed for contract work, and prior to substantial completion of work. Mobilization and demobilization of the on-site geotechnical laboratory is paid for under Item 2. The cost of performing the required testing and sampling, including personnel, consumable supplies, power, utilities and report preparation associated with the geotechnical laboratory shall be paid for under the individual work items for which testing is required.

6. SITE CLEARING AND GRUBBING

6.1 General: Under this Item the Contractor shall clear and grub the landfill area to facilitate construction, chip the cleared and grubbed material, and disposal by spreading throughout the landfill area prior to placing the initial fill. This Item shall also include the cleanup and disposal of surface debris within the limits of the site.

6.2 Work Included: The work under this Item includes all labor, materials, equipment, and services necessary for, and incidental to, the clearing and grubbing of any vegetative cover on the landfill area, chipping the cleared and grubbed material, and its disposal by spreading throughout the landfill prior to placing the initial fill. Clearing shall also include handling and disposal, within the landfill limits and under the final landfill cover of surface debris encountered at the site including, but not limited to cars, old fencing, etc.

6.3 Payment: The lump sum price bid per Item 6 shall be compensation in full for the work of clearing and grubbing the landfill area and disposal of surface debris as specified herein.

7. CONSTRUCTION WATER MANAGEMENT AND DISPOSAL

7.1 General: Under this Item the Contractor shall collect and dispose of construction water generated during the construction of the remedial measures at the landfill.

7.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and services required to manage and dispose of construction water generated during construction of remedial measures at the landfill. The work shall include, but not be limited to, development of an acceptable construction water management plan, obtaining necessary permits to implement the approved construction water management plan, and the implementation of the approved construction water management plan. Implementation of the approved construction water management plan includes, but is not limited to, required sampling and analysis; necessary permits; and the provision of necessary labor, equipment, fuel or standby power, construction of necessary holding facilities, and ancillary items for management and disposal of construction water in accordance with applicable State and Federal laws, regulations, and requirements.

7.3 Payment: The lump sum bid for Item 7 shall constitute payment in full for the work of removing and disposal of construction water generated during construction of remedial measures at the landfill.

8. EARTHWORK

8.1 General: Under this Item the Contractor shall perform earthwork on the landfill site. In general, the earthwork shall consist of excavation of unclassified materials on the landfill site, including excavation for general grading cuts, movement of existing saprolite stockpiles, fill/refuse relocation from outside the limits of the final landfill cover and from within the Jersey Central Power and Light (JCPL) Right of Way (ROW) to within the limits of the final landfill cover, and regrading of refuse from high points to low points within the limits of the final cover, grading and compaction of regraded and relocated fill/refuse and other excavated unclassified materials.

This Item does not include the excavation, hauling, placement and compaction of embankment material from off-site sources. Off-site embankment is paid for under a separate Item. Furthermore, the work of this Item does not include earthwork, excavation, grading and compaction within the site that is paid for under Items for the final cover system, drainage structures, gas collection system, and shallow ground water recovery system.

8.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and services required to perform earthwork on the landfill site.

The work under this Item includes the excavation of unclassified materials on the landfill site, including excavation for general grading cuts, movement of existing saprolite stockpiles, and similar work. Excavated, unclassified

materials suitable for use as embankment or other fill material shall be moved to those locations on the site where the fill materials are required, including locations within the limits of the final landfill cover. Excavated, unclassified, material not suitable for use as embankment or other fill shall be disposed of on site at locations approved by the Engineer. The excavated materials shall be moved, placed, and compacted in accordance with the requirements of the specifications and as shown on the plans. Excavated, unclassified materials from on-site sources suitable for use as embankment material shall be used prior to the importation of off-site embankment material (paid for under Item 9) unless otherwise approved by the Engineer.

The work under this Item also includes the relocation of fill/refuse from outside the limits of the final landfill cover and from within the power line ROW, and placing it within the limits of the final landfill cover. This Item also includes regrading of fill/refuse from high points to low points within the limits of the final landfill cover. Under this Item, all exposed fill/refuse shall be provided with a temporary cover in accordance with the specifications. If off-site embankment material is used for the temporary cover, the work associated with initial excavation and hauling the off-site material shall be paid for under Item 9. Placement of off-site embankment material used as temporary cover shall be paid for under this Item.

The work under this Item shall include all sheeting, shoring, bracing, and dewatering necessary to perform earthwork, loading to haul vehicles as required, stockpiling as required, hauling and moving the excavated materials to the areas to be filled, unloading and placement of the materials, and compaction of the materials to the lines and grades shown on the plans, as specified or as directed by the Engineer, together with all appurtenant work. The work shall also include sampling and analysis as required in the Construction Quality Control Plan.

8.3 Payment: The unit price bid per cubic yard for Item 8 shall be compensation in full for performing earthwork. Measurement for payment of earthwork under Item 8 shall be based on measurements of taken before and after excavation. The Contractor shall provide necessary surveys for determining the volumes for payment. The quantity measured for payment shall be the actual number of cubic yards of materials excavated within the lines and grades shown on the Drawings, and as established by the Engineer. Computation of the quantity of excavation shall be based on cross-section measurements at intervals of 50 feet or less with volume computed by the "average end area" method. Other methods of computing volume may be used if deemed acceptable by the Engineer.

9. OFF-SITE EMBANKMENT MATERIAL

9.1 General: Under this Item the Contractor shall locate off-site a suitable source of embankment material to haul to the landfill for use as fill to achieve required lines and grades as shown on the plans or for use as temporary cover material.

9.2 Work Included: Under this Item the Contractor shall furnish all labor, equipment, materials, and services required to haul on-site, grade, and compact embankment material to achieve required lines and grades as shown on the plans, as specified or as directed by the Engineer, as well as the provision of embankment material for use as temporary cover. The work shall

include, but not be limited to: purchasing, loading, transporting, delivery to site, unloading, and placing and compacting embankment fill from off-site to the required lines and grades; obtaining necessary mining and hauling permits; sampling and testing all sources of embankment material for compliance with material requirements; grading to the contours of the grading plan below the soil barrier layer; compacting to the specified moisture content, and density. Excavated, unclassified materials from on-site sources suitable for use as embankment material (paid for under Item 8) shall be utilized prior to the importation of off-site embankment material, unless otherwise approved by the Engineer.

9.3 Payment: The basis of payment shall be by volume based upon visual inspection by the Engineer of delivery truck containing the embankment material. The unit price bid per cubic yard of off-site embankment material furnished, accepted and satisfactorily placed and compacted shall be compensation in full for the work of Item 9.

10. SOIL BARRIER LAYER TEST SECTION

10.1 General: Under this Item the Contractor shall construct a soil barrier layer test section to demonstrate that his proposed soil barrier layer material and placement methodologies will meet the Contract requirements.

10.2 Work Included: Under this Item the Contractor shall furnish all labor, equipment, material, and services required to provide a soil barrier layer test section as presented in the specifications. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; purchasing, loading, transporting, delivery to the site, unloading, handling, necessary mixing, placement and compaction to the required moisture content, density, and permeability, and testing of the completed test section.

10.3 Payment: The lump sum bid price for Item 10 shall constitute compensation in full for the work of constructing the soil barrier layer test section. Should the test strip be accepted as a section of the permanent cap, it will be paid for under the appropriate Item for the soil barrier layer, and payment for Item 10 shall be in addition thereto.

11. SOIL BARRIER LAYER

11.1 General: Under this Item, the Contractor shall furnish and install a soil barrier layer over the graded and compacted fill/refuse. The soil barrier layer shall have a maximum permeability of 1×10^{-7} centimeters per second (cm/sec) and shall have a minimum finished thickness of 24 inches. The Contractor must provide bid prices for one of two soil barrier layer options; a natural clay soil layer, or a bentonite amended soil barrier layer determined at his discretion.

11.2 Work Included: Under this Item the Contractor shall furnish all labor, equipment, materials, and services required to provide a soil barrier layer to the lines and grades shown on the plans and as presented in the specifications. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling, necessary mixing and

handling, placement and compaction in lifts having a maximum thickness of eight inches to the required moisture content, density, and permeability. The material shall be placed as so as to result in a minimum layer thickness of 24 inches and so as to conform to the grade and slopes of the initial graded base. The work of this Item also includes the provision of a cap key as shown on the Plans in areas where the gabion wall is not present. The work of this Item also includes required quality assurance/quality control testing and submission of the test results to the Engineer. Under this Item, the Contractor will maintain this soil barrier layer for the duration of the Contract.

11.3 Payment: The unit price bid per cubic yard for Item 11, furnished in place, accepted as satisfactorily placed and compacted shall be compensation in full for the work of providing the compacted 24 in. thick soil barrier soil layer for the landfill closure area including keying of the clay into the subgrade where shown on the plans. The quantity measured for payment shall be the area covered by the soil barrier layer multiplied by the 24-in. depth of compacted barrier soil, in cubic yards. The Contractor shall provide necessary surveys for determining the volume for payment.

12. FLEXIBLE MEMBRANE COVER

12.1 General: Under this Item the Contractor shall furnish and install a flexible membrane cover consisting of 40 mil Very Low Density Polyethylene material on the landfill area with slopes less than 10%.

12.2 Work Included: Under this Item the Contractor shall be responsible for the manufacture, fabrication, furnishing, and installation of the flexible membrane cover. All work shall be performed in strict compliance with the manufacturer's recommendations, as approved by the Engineer, the drawings and Specifications. This shall include all quality assurance/quality control testing, equipment, and submittals required in the Specifications. The Contractor shall provide as-built drawings (updated weekly) showing panel/roll numbers, layout plan, seam location and identification, and the location of patches, destructive seam samples, and penetrations, and anchorage details. Work shall be performed by qualified persons approved by the Engineer.

12.3 Payment: The unit price bid per square foot of liner for Item 12 installed in place accepted and approved shall be compensated in full for the work of providing the liner on slopes less than 10% over the landfill closure area. This area shall be determined based on as-built drawings of panel layout as provided by the Contractor and approved by the Engineer. No payment shall be made for overlaps, splices, repairs, seams, and anchorages.

13. GEOTEXTILE FILTER

13.1 General: Under this Item the Contractor shall furnish and install geotextile fabrics to be used as filter fabric. These geotextiles shall be placed as shown on the plans, as specified, or as directed by the Engineer.

13.2 Work Included: Under this Item the Contractor shall furnish all material, labor, and equipment required to install the geotextile filters in accordance with the plans and Specifications. This shall include all quality assurance/quality control testing, and installation approved by the Engineer.

13.3 Payment: This unit price bid per square foot of geotextile for Item 13 installed where identified in the plans and approved by the Engineer shall be compensation in full for the work of installing the geotextile. This area shall be determine based on as-built drawings provided by the Contractor and approved by the Engineer. No payment will be made for geotextiles used for repairs, seams, or overlaps.

14. DRAINAGE LAYER

14.1 General: Under this Item, the Contractor shall furnish and install a soil drainage layer with a minimum permeability of 1×10^{-2} cm/sec to a minimum thickness of 12 inches above the soil barrier layer.

14.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide a soil drainage layer with a minimum permeability of 1×10^{-2} cm/sec to a minimum thickness of 12 inches as shown on the plans and as specified. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling, and placement in accordance with the material specifications and plans. The material shall be placed so as to result in a minimum layer thickness of 12 inches and so as to conform to the grade and slopes of the initial graded base. The work of this Item also includes required quality assurance/quality control testing and submission of the test results to the Engineer. Under this Item, the Contractor will maintain the drainage layer for the duration of the Contract.

14.3 Payment: The unit price bid per cubic yard of drainage layer material for Item 14, furnished in place and accepted shall be compensation in full for the work of providing the 12-inch thick drainage layer over the soil barrier layer of the landfill cover system. The quantity measured for payment shall be the area covered by the drainage material layer multiplied by the 12-inch depth of drainage layer material, in cubic yards. The Contractor shall provide necessary surveys for determining the volume for payment.

15. VEGETATIVE LAYER

15.1 General: Under this Item, the Contractor shall furnish and install a vegetative layer to a minimum thickness of 18 inches above the drainage layer.

15.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide a vegetative layer having a minimum thickness of 18 inches. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling and placement in accordance with the material specifications and plans. The material shall be placed so as to result in a minimum layer thickness of 18 inches and so as to conform to the grade and slopes of the initial graded base. The work of this Item also includes required quality assurance/quality control testing and submission of the test

results to the Engineer. Under this Item, the Contractor will maintain the vegetative layer for the duration of the Contract.

15.3 Payment: The unit price bid per cubic yard of vegetative layer material for Item 15 furnished in place, accepted and satisfactorily placed and compacted shall be compensation in full for the work of placing the vegetative layer component of the final cover. The quantity measured for payment shall be the area covered by the vegetative layer multiplied by the 18-inch thickness of compacted material in cubic yard. The Contractor shall provide necessary surveys for determining the volume for payment.

16. CAP SIDE SLOPE SURFACE WATER DIVERSION DITCHES

16.1 General: Under this Item the Contractor shall construct and maintain cap side slope surface water drainage ditches as shown on the plans, specified, or directed by the engineer.

16.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to construct and maintain the cap side slope surface water diversion ditches as shown on the plans, specified, or directed by the engineer. The work shall include, but not be limited to: excavation and grading required to shape the cap side slope surface water diversion ditches. The provision of the six inch bedding layer and light rip-rap shall be paid for under Item 38.

16.3 Payment: The unit price bid per linear foot of cap side slope surface water diversion ditch for Item 16, constructed, accepted, satisfactorily placed and maintained shall be compensation in full for the work of constructing the cap side slope surface water diversion ditches as shown on the plans, as specified, or as directed by the Engineer.

17. CAP DRAINAGE DITCHES

17.1 General: Under this Item the Contractor shall construct and maintain cap drainage ditches as shown on the plans, specified, or directed by the engineer.

17.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to construct and maintain the cap drainage ditches as shown on the plans, specified, or directed by the engineer. The work shall include, but not be limited to: excavation and grading required to shape the cap drainage ditches. The provision of the six inch bedding layer and medium rip-rap shall be paid for under Item 38.

17.3 Payment: The unit price bid per linear foot of cap drainage ditch for Item 17 constructed, accepted, satisfactorily placed and maintained shall be compensation in full for the work of constructing the cap drainage ditches as shown on the plans, as specified, or as directed by the Engineer.

18. TOPSOIL

18.1 General: Under this Item, the Contractor shall furnish, place, and maintain a 6-inch thick layer of topsoil above the vegetative layer within the limits of the final cover.

18.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide and maintain a topsoil layer within the limits of the final cover. The topsoil layer shall have a minimum final thickness of six inches. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting delivery to the site, unloading, handling, and placement in accordance with the material specifications and plans. The material shall be placed so as to have a minimum thickness of six inches and so as to conform to the grade and slopes of the underlying material. The work of this Item also includes required quality assurance/quality control testing and submission of test results to the Engineer. Under this Item, the Contractor will maintain the topsoil layer for the duration of the Contract.

18.3 Payment: The unit price bid per cubic yard of topsoil for Item 18 furnished, accepted and satisfactorily placed, compacted, and maintained shall be compensation in full for the work of providing topsoil above the vegetative layer within the landfill closure area. The quantity measured for payment shall be the area covered by the imported topsoil multiplied by the 6-inch thickness of compacted topsoil, in cubic yards. The Contractor shall provide necessary surveys for determining the volume for payment.

19. SEEDING

19.1 General: Under this Item, the Contractor shall seed the entire landfill closure area, including the limits of the final cover and disturbed areas exterior to the limits of the final cover, to provide a vegetative cover system in accordance with the Specifications. The Contractor shall maintain the vegetative cover for the duration of the Contract.

19.2 Work Included: Under this Item, Contractor shall furnish all labor, materials, equipment, and services required to seed the entire landfill cover area, including the limits of the final cover and disturbed areas exterior to the limits of the final cover. The work shall include, but not be limited to: soil testing to determine fertilizer requirements; submission of test reports to the Engineer, furnishing and storing until needed seed, lime, fertilizer and mulch; preparation of the seed bed; seeding with the specified seed mix; application of fertilizer; mulching; securing of mulch for establishment of the vegetative cover; and all other operations required to complete the work of grass seeding. Under this Item, the Contractor will maintain the vegetative cover established by seeding for the duration of the Contract.

19.3 Payment: The unit price bid per acre seeded for Item 19, accepted and producing a vegetative cover system satisfactory to the Engineer shall be compensation in full for the work of seeding. The Contractor shall provide necessary surveys for determining the area for payment.

20. GABION WALL

20.1 General: Under this Item the Contractor shall furnish work, materials and operations required for the construction of a gabion wall along the landfill perimeter. The gabion wall is depicted on the plans and discussed in the Specifications.

20.2 Work Included: The work under this Item includes all labor, materials, equipment, and services necessary for and incidental to the construction of gabion retaining walls along portions of the landfill perimeter. This shall include all excavation, backfilling, assembly, transporting, storage, fill, disposal, and testing of all material necessary for construction of the gabions as shown or specified or as directed by the Engineer.

20.3 Payment: The unit price bid per cubic yard of wall for Item 20 shall be compensation in full for the work of installing the gabion walls as specified herein. The quantity measured for payment shall be the actual cubic yardage of gabion wall installed.

21. 4-INCH DIAMETER POLYVINYL CHLORIDE (PVC) PIPE

21.1 General: Under this Item the Contractor shall furnish and install PVC drainage pipe in the drainage layer of the final landfill cover. Both perforated and solid PVC drainage pipe is included under this Item.

21.2 Work Included: The work under this Item includes all labor, materials, supplies, equipment, and services necessary for and incidental to the construction and installation of perforated and solid PVC drainage pipe.

21.3 Payment: The unit price bid per lineal foot of PVC pipe for Item 21 satisfactorily placed, accepted and maintained shall be compensation in full for the work of installing the perforated and solid PVC drainage pipe. The quantity measured for payment shall be the actual number of feet of PVC drainage pipe installed.

22. CAP DRAINAGE VAULTS

22.1 General: Under this Item the Contractor shall furnish and install cap drainage vaults as depicted on the plans and as specified.

22.2 Work Included: The work under this Item includes all labor, materials, equipment, and services necessary for and incidental to the construction of cap drainage vaults as depicted on the plans, specified or directed by the Engineer.

22.3 Payment: The unit price bid per drainage vault for Item 22 shall be compensation in full for the work of constructing cap drainage vaults. The quantity measured for payment shall be the actual number of cap drainage vaults installed.

23. ROAD GRADING

23.1 General: Under this Item, the Contractor shall grade 24 foot wide main access road to the landfill, the 18 foot wide access road to the process equipment building, an 18 foot wide access road to the gas extraction building, a 12 foot wide gravel access road around the landfill perimeter, and the parking lot at the process equipment building. Shaping of ditches associated with the various roads is also included under this Item.

23.2 Work Included: Under this Item the Contractor shall furnish all labor, equipment, materials, and services required to construct, grade and prepare a 24 foot wide main access road to the landfill, a 18 foot wide access road to the process equipment building, a 18 foot wide access road to the gas

extraction building, a 12 foot wide gravel access road around the landfill perimeter, and the parking lot at the process equipment building. The work shall include shaping of ditches associated with the access roads and the parking lot. The work shall include, but not be limited to: bringing the base to grade and cross section as shown on the plans; thoroughly compacting the base; and shaping perimeter ditches associated with the roads and parking lot. For purposes of this Payment Item, the exit road in the vicinity of the process equipment building between the edge of the 24 foot wide main access road and the edge of the 18 foot wide access road shall be treated in a manner similar to the parking lot. All work shall be in accordance with the plans and specifications.

23.3 Payment: The unit price bid per linear foot for Item 23 shall be compensation in full for grading and maintaining the 24 foot wide main access road, the 18 foot wide access roads to the process equipment building and gas extraction buildings, and the 12 foot wide gravel access road around the landfill perimeter. The quantity measured for payment shall be the actual linear footage of 24 foot wide main access road, the actual linear footage of 18 foot wide access roads to the process equipment building and the gas extraction building, and the 12 foot wide gravel access road around the landfill perimeter and the actual square footage of parking area in the vicinity of the process equipment building.

24. GRAVEL ACCESS ROAD MATERIAL

24.1 General: Under this Item the Contractor shall furnish, place and maintain a minimum of 12 inches of Type I-5 gradation material on the 12 foot wide gravel access road around the landfill perimeter.

24.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide and maintain a minimum thickness of 12 inches of Type I-5 gradation material on the 12 foot wide gravel access road around the landfill perimeter. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling, and placement in accordance with the material specifications and plans. The work of this Item also includes the required quality assurance/quality control testing and submission of test results to the Engineer. Under this Item, the Contractor will maintain the 12 foot wide gravel access road around the landfill perimeter for the duration of the Contract.

24.3 Payment: The unit price bid per cubic yard of Type I-5 gradation material for Item 24 furnished, accepted and satisfactorily placed, compacted, and maintained shall be compensation in full for the work of providing crusher run material. The quantity measured for payment shall be by volume based upon visual inspection by the Engineer of delivery trucks containing the access road material.

25. GRANULAR SUB-BASE FOR PAVED ACCESS ROADS

25.1 General: Under this Item the Contractor shall furnish, place and maintain a minimum of 12 inches of Type I-5 gradation sub-base material on the 24 foot wide main access road, the 18 foot wide access road to the

process equipment building, the 18 foot wide access road to the gas extraction building, and the parking lot in the vicinity of the process equipment building.

25.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide and maintain a minimum thickness of 12 inches of granular sub-base on the 24 foot wide main access road, the 18 foot wide access road to the process equipment building, the 18 foot wide access road to the gas extraction building, and the parking lot in the vicinity of the process equipment building. For purposes of this Payment Item, the exit road in the vicinity of the process equipment building between the edge of the 24 foot wide main access road and the edge of the 18 foot wide access road shall be treated in a manner similar to the parking lot. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling, and placement in accordance with the material specifications and plans. The work of this Item also includes the required quality assurance/quality control testing and submission of test results to the Engineer. Under this Item, the Contractor will maintain the granular sub-base for on the 24 foot wide main access road, the 18 foot side access road to the process equipment building, the 18 foot wide access road to the gas extraction building, and the parking lot in the vicinity of the process equipment building.

25.3 Payment: The unit price bid per cubic yard of granular sub-base for Item 25 furnished, accepted and satisfactorily placed, compacted, and maintained shall be compensation in full for the work of providing granular sub-base material. The quantity measured for payment shall be by volume based upon visual inspection by the Resident Engineer of delivery truck containing the granular sub-base material.

26. BITUMINOUS PAVING

26.1 General: Under this Item the Contractor shall furnish, place and maintain a minimum total thickness of 6 inches of bituminous pavement on the main access road, the access roads to the process equipment building and the gas extraction building, and the parking lot in the vicinity of the process equipment building. The bituminous pavement shall be place to a width of 12 feet on the access roads, and shall consist of a minimum 3 inch base course, 1.5 inch binder course and a 1.5 inch top course.

26.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials and services required to provide and maintain a minimum total thickness of 6 inches of bituminous pavement on the main access road, the roads to the process equipment building and the gas extraction building, and the parking lot in the vicinity of the process equipment building. The bituminous pavement shall be placed to a width of 12 feet on the access roads, and shall consist of a minimum 3 inch base course, 1.5 inch binder course and a 1.5 inch top course. The entire parking area shall be paved. For purposes of this Payment Item, the exit road in the vicinity of the process equipment building between the edge of the 24 foot wide main access road and the edge of the 18 foot wide access road shall be treated in a manner similar to the parking lot. The work shall include, but not be limited to, sampling and testing all sources of material for compliance with

material specifications; obtaining necessary mining and hauling permits; purchasing, loading, transporting, delivery to the site, unloading, handling, and placement in accordance with the material specifications and plans. The work of this Item also includes the required quality assurance/quality control testing and submission of test results to the Engineer. Under this Item, the Contractor will maintain the bituminous pavement for the duration of the contract.

26.3 Payment: The unit price bid per cubic yard of base course, binder course and top course, for Item 26 accepted and satisfactorily placed, rolled, and maintained shall be compensation in full for the work of providing binder course and top course material. The quantity measured for payment shall be by volume based upon visual inspection by the Engineer of delivery trucks containing the bituminous pavement.

27. TEMPORARY REPAIRS TO OFF-SITE PUBLIC ROADS

27.1 General: Under this Item, the Contractor shall make temporary repairs to public roads damaged by his work in connection with this Contract.

27.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to maintain during construction public roads damaged by the Contractor's trucking operations while conveying off-site borrow or other materials to the landfill site, or by other work by the Contractor in connection with this Contract. The work shall include, but not be limited to, adding bituminous concrete surface course material to public roads which have been damaged by the Contractor's trucking operations while conveying off-site borrow or other materials to the landfill site, or as required or as necessary by damage during use. All repairs shall be in accordance with the specifications, as directed by the Engineer, and in accordance with all applicable Federal, State and Local requirements.

27.3 Payment: The unit price bid per square yard of roadway for Item 27 shall be compensation in full for temporary repairs and maintenance of off-site public roads in accordance with the specifications, as directed by the Engineer, and in accordance with all applicable Federal, State, and Local requirements.

28. PERMANENT REPAIRS TO OFF-SITE PUBLIC ROADS

28.1 General: Under this Item, the Contractor shall make permanent repairs to public roads damaged by his work in connection with this Contract.

28.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to permanently repair public roads (in kind) damaged by the Contractor's trucking operations while conveying off-site borrow or other materials to the landfill site, or by other work by the Contractor in connection with this Contract. The work shall include, but not be limited to, squaring out damaged areas, removing and disposing of off-site to an approved location the existing surface and base course, reconstructing the sub-grade as necessary, adding as necessary, gravel or crushed stone aggregate to result in a compacted sub-base course, applying a binder course and a top course. All repairs shall be in accordance with the specifications, as directed by the Engineer, and in accordance with all applicable Federal, State and Local requirements.

28.3 Payment: The unit price bid per square yard of roadway for Item 28 shall be compensation in full for permanent repairs and maintenance of off-site public roads in accordance with the specifications, as directed by the Engineer, and in accordance with all applicable Federal, State, and Local requirements.

29. ABOVE GRADE GAS EXTRACTION WELL

29.1 General: Under this Item the Contractor shall construct and maintain during construction the above grade gas extraction wells at the locations shown on the Drawings and as specified, or directed by the Engineer.

29.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to construct and maintain during construction the above grade piping gas extraction wells and fittings at the locations shown on the Drawings and as specified. The work shall include but not be limited to: on-site disposal of fill/refuse material encountered during drilling and constructing the borehole with a minimum diameter of 24 inches; installation of 6-inch schedule 40 PVC slotted well screen and 4-inch schedule 40 PVC threaded joint slotted well screen with plugged bottom, granular filter pack, filter fabric with band clamp, telescoping joint, bentonite seal, 4-inch PVC threaded cap with 1/4 inch NPT plug test port, 4-inch butterfly valve; test port 1/4-inch ball valve; 4-inch PVC flexible hose (reinforced); pipe support; 4-inch fiberglass pipe; fiberglass tee header and their associated fittings and couplings, all as shown on the plans and as specified.

29.3 Payment: The unit price bid per well for Item 29, based upon an assumed length of 30 vertical linear feet (VLF) of above grade piping gas extraction well, measured from the bottom of the well screen to the top cap of the well, shall be compensation in full for constructing and maintaining during construction above grade piping gas extraction wells at the locations and as shown on the Drawings and as specified. Reference Item 31, "ADD or DEDUCT PER VLF OF GAS EXTRACTION WELL." If the above grade piping gas extraction well measures a VLF greater than or less than 30 VLF, the difference shall be made under Item 31.

30. BELOW GRADE GAS EXTRACTION WELL

30.1 General: Under this Item the Contractor shall construct and maintain during construction the below grade gas extraction wells at the locations shown on the plans and as specified, or directed by the Engineer.

30.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment, and services required to construct and maintain during construction the below grade piping gas extraction wells and fittings at the locations shown on the Drawings and as specified. The work shall include, but not be limited to: on-site disposal of fill/refuse material encountered during drilling and constructing the borehole with a minimum diameter of 24 inches, installation of 6-inch schedule 40 PVC slotted well screen and 4-inch schedule 40 PVC threaded joint slotted well screen with plugged bottom, granular filter pack, bentonite seal; 4-inch PVC threaded cap; 4-inch butterfly valve; test port 1/4-inch ball valve; 4-inch PVC flexible hose (reinforced); pipe support; 4-inch fiberglass pipe; fiberglass tee header and

55.2 Work Included: Under this Item, the Contractor shall furnish all labor, material, and services required for preparing and submitting the Spill and Discharge Control Plan described in Section 01100- Special Project Procedures and Section 01130- Spill and Discharge Control.

55.3 Payment: The lump sum bid price for Spill and Discharge Control Plan Development shall be compensation in full for the work of preparing the Spill and Discharge Control Plan and Shall be payable upon acceptance of the Spill and Discharge Control Plan. No additional payment will be made for implementing the Spill and Discharge Control Plan.

56. QUALITY CONTROL PLAN

56.1 General: Under this Item, The Contractor shall prepare and submit a Quality Control Plan in accordance with requirements contained in Section 01100 - Special Project Procedures and Section 01400 - Contractor Quality Control.

56.2 Work Included: Under this Item, the Contractor shall furnish all labor, material, and services required for preparing and submitting the Quality Control Plan described in Section 01100 - Special Project Procedures and Section 01400 - Contractor Quality Control.

56.3 Payment: The lump sum bid price for Quality Control Plan Development shall be compensation in full for the work of preparing and submitting the Quality Control Plan and shall be payable upon acceptance of the Quality Control Plan. Payment for implementation of the Quality Control Plan is to be included in the work of other Items.

57. SECURITY PLAN

57.1 General: Under this Item, the Contractor shall prepare, submit, and implement a Security Plan in accordance with Requirements contained in Section 01100 - Special Project Procedures.

57.2 Work Included: Under this Item, the Contractor shall furnish all labor, material, and services required for preparing, submitting, and implementing the Dust Control Plan described in Section 01110 - Special Project Procedures.

57.3 Payment: The lump sum bid price for Security Plan Development shall be compensation in full for the work of preparing the Security Plan and shall be payable upon acceptance of the Security Plan. The lump sum bid price for Security Plan Implementation shall be compensation in full for the work of implementing the Security Plan. Payment for the implementation of the Dust Migration Control will be made in equal monthly installments from the Notice to Proceed. The equal monthly installments shall be based on the time remaining following the Notice to Proceed utilizing the contract duration contained in the Contract Documents.

58. HEALTH AND SAFETY PLAN

58.1 Under this Item, the Contractor shall prepare, submit, and implement a Health and Safety Plan and acceptable Health and Safety Plan (HASP) in accordance with requirements presented in Section 01110 - Safety, Health, and Emergency Response.

58.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, and services required for preparing, submitting and implementing the HASP as specified in Section 01110 - Safety, Health, and Emergency Response. The work of this Item does not include preparation and implementation of the of the Air Monitoring Plan as presented in Part 3.06 of Section 01110 - Safety, Health, and Emergency Response. Work associated with the Air Monitoring Plan is paid for under another Item.

58.3 Payment: The lump sum bid price for Health and Safety Plan Development shall be compensation in full for the work of preparing the Health and Safety Plan. The lump sum bid price for Health and Safety Plan Implementation shall be compensation in full for the work of implementing the Health and Safety Plan. Payments for the implementation of the Health and Safety Plan will be made in equal monthly installments from the Notice to Proceed. The equal monthly installments shall be based on the time remaining following the Notice to Proceed utilizing the contract duration contained in the Contract Documents.

59. DRUM REMOVAL

59.1 General: Under this Item, the Contractor shall handle any drums encountered during construction activities at the site.

59.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, and services required for handling drums encountered during construction activities at the site. Drums are to be handled in accordance with Section 02280 - Drum Removal. This work includes, but is not limited to:

- Preparation of a Sampling, Analysis and Waste Characterization (SAWC) Plan;
- Construction of a drum staging area;
- Evaluation for evidence documentation in place;
- Evidence documentation in place (if applicable);
- Temporary relocation and staging of drums adjacent to the excavation for further evidence documentation;
- Compatibility sampling;
- Stabilization of the drum, including placement in new overpack drums, tarping, fitting pressure reliefs valve and other necessary activities to stabilize the drums

their associated fittings and couplings. All work shall be as shown on the plans and as specified.

30.3 Payment: The unit price bid per well for Item 30, based upon an assumed length of 30 vertical linear feet (VLF) of below grade piping gas extraction well measured from the bottom of the well screen to the top cap of the well, shall be compensation in full for constructing and maintaining during construction below grade piping gas extraction wells at the locations and as shown on the Drawings and as specified. Reference Item 31, "ADD OR DEDUCT PER VLF OF GAS EXTRACTION WELL". If the below grade piping gas extraction well measures a VLF greater than or less than 30 VLF, the difference shall be made under Item 31.

31. ADD OR DEDUCT PER VLF OF GAS EXTRACTION WELLS

31.1 General: Under this Item the Contractor shall provide or receive compensation for the difference between the 30 Vertical Linear Feet (VLF) used to estimate the base depth drilled for the borehole for the above grade and below grade piping gas extraction wells. The difference is the depth to the bottom of the well drilled either less than or greater than 30 VLF. The above grade and below grade piping gas extraction wells locations are shown on the plans, as specified, or as directed by the Engineer.

31.2 Work Included: Under this Item the Contractor shall provide or receive compensation for the difference between 30 VLF base depth estimated for the borehole for the above grade and below grade piping gas extraction wells. The difference is the depth of the bottom of the well drilled compared to the base depth of 30 VLF. The work shall include, but not be limited to, on-site disposal of fill/refuse material encountered during drilling and constructing the borehole with a minimum diameter of 24 inches, installation of 6-inch schedule 40 PVC slotted well screen and 4-inch schedule 40 PVC threaded joint slotted well screen and granular filter pack, as shown on the plans and as specified.

31.3 Payment: The unit price bid per vertical linear foot (VLF) less than or greater than the 30 VLF base depth for the above grade and below grade piping gas extraction wells measured from the bottom of the well screen to the top cap of the well (the difference being in the bottom of the well drilled) shall be compensation in full for constructing and maintaining during construction the above grade and below grade piping gas extraction wells at the locations and as shown on the plans and as specified. Reference Item 29, "ABOVE GRADE GAS EXTRACTION WELL" and Item 30, "BELOW GRADE GAS EXTRACTION WELL" for a description of the payment for the 30 VLF base depth.

32. GAS HEADER PIPING AND FITTINGS

32.1 General: Under this Item the Contractor shall furnish, install, and maintain the gas header piping and fittings used in the gas extraction system. This Item includes work to within five feet of the gas extraction building.

32.2 Work Included: The work under this Item includes all labor, material, equipment, and services necessary for, and incidental to, construction of the gas header piping and fittings. This includes, but is not limited to the following:

Gas header fittings - Installation of miscellaneous pipe and valve fittings for the gas header system.

Miscellaneous pipe excavation - Trenching, backfill, and compaction of soils around and over the below ground gas header piping.

Below ground gas header piping - Installation of PVC pipe of the classification and with fittings and joints as specified and as shown on the Contract Drawings. This pipe shall be installed in the trenching discussed above and as shown on the plans.

Above ground gas header piping - Installation of fiberglass reinforced epoxy resin piping and all the necessary fittings and accessories as specified and as shown in the Contract Documents. This includes painting the fiberglass reinforced epoxy resin pipe as specified and required pipe supports.

Cast-in-place concrete pipe anchors - All cast-in-place concrete pipe anchors used in the construction of pipelines and appurtenances. This includes reinforcing steel, formwork, and items of concrete accessories required for the completion of work.

Gas header valves, gas piping access manholes and valve boxes - Installation of all valves and valve boxes necessary for the landfill gas collection header system.

Also, included under this Item is all ancillary work associated with the landfill gas header system. This includes testing of fittings, valves and pipes, submittal of all required documentation, and other miscellaneous work.

32.3 Payment: The unit price bid for Item 32 shall be compensation in full for the work of constructing the landfill gas header piping and fittings. The measurement for payment shall be the actual linear footage of pipe installed.

33. CONDENSATE COLLECTION SYSTEM

33.1 General: Under this Item the Contractor shall install a landfill gas condensate collection system. This system will be used to collect excess moisture from landfill gas as it condenses in the piping system. The condensate will drain by gravity to condensate sumps from where it will be pumped to a holding tank. This Item includes work associated to within five feet of Tank 102 as shown on the plans and as specified.

33.2 Work Included: The work included under this Item includes all labor, material, equipment, and services necessary for, and incidental to, construction of the condensate collection system. This includes, but is not limited to the following:

Condensate collection manholes - Installation of the concrete condensate collection manholes as specified and shown on the plans.

Condensate piping - Trenching, installation, backfill, and compaction around below grade condensate piping and force mains, as specified and shown on the plans. This shall include condensate drain line cleanouts.

Gravity Condensate Collection Piping Manholes - Installation of the concrete condensate pipe access manholes as specified and shown on the plans.

Multiple Gas Header Condensate Collection Vault - Installation of the concrete multiple gas header condensate collection vaults as specified and shown on the plans.

Condensate Pump Stations - This shall include construction of the condensate pump stations as specified and shown on the plans. This includes installation of sump manholes, valve boxes, station access doors, miscellaneous valves, station piping, miscellaneous fittings, and duplex submersible pump stations.

Electrical - This shall include installation of all electric service, components, meters, and switches as specified and shown in the Contract Documents.

33.3 Payment: The lump sum price bid for Item 33 shall be compensation in full for the work of constructing the landfill gas condensate collection system.

34. LANDFILL GAS TREATMENT SYSTEM

34.1 General: Under this Item, the Contractor shall furnish, install, start-up and place into service the landfill gas treatment system as shown on the plans and as specified.

34.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to construct and place into service the landfill gas blower system as shown on the plans and as specified. The work shall include, but not be limited to:

- Site work
- Structural elements (gas extraction building)
- Architectural elements (gas extraction building)
- Process equipment including the enclosed flare
- Electrical, instrumentation and control systems
- Heating and ventilating
- Plumbing
- System start-up and performance testing

The work of the Item shall include those facilities within the perimeter fence of the ground water treatment system and gas extraction building associated with the landfill gas treatment system.

34.3 Payment: The lump sum price bid for Item 34 shall be payment in full for the work of construction, start up and placing into service the landfill gas blower system.

35. REINFORCED CONCRETE PIPE

35.1 General: Under this Item the Contractor shall install reinforced concrete storm sewer drainage piping at the locations shown on the Contract Drawings or where directed by the Engineer.

35.2 Work Included: The Contractor shall furnish all labor, materials, equipment to install all reinforced concrete storm sewer piping as shown or as directed by the Engineer. The work shall include, but not limited to: trenching to the depth required, rock excavation (if encountered), sheeting as required, dewatering, backfilling and compaction over pipe, dust control, furnishing and installing RCP of the class and size and closure pieces as specified in the Pipe Schedule below. Pipe shall conform to Section 02612 - "Reinforced Concrete Non-Pressure Pipe".

Pipe Schedule:

<u>Size</u>	<u>Type of Pipe</u>	<u>Joints</u>
12"	RCP	Concrete and rubber per ASTM C443
15"	RCP	Concrete and rubber per ASTM C443
18"	RCP	Concrete and rubber per ASTM C443
21"	RCP	Concrete and rubber per ASTM C443
30"	RCP	Concrete and rubber per ASTM C443
36"	RCP	Concrete and rubber per ASTM C443
48"	RCP	Concrete and rubber per ASTM C443

- All RCP shall be Class V.

35.3 Payment: The unit price bid for which payment will be made will be the number of linear feet of storm sewer pipe of each scheduled size, type and class measured along the centerline of the pipe, incorporated in the completed work beginning and ending at the centerline of structures or at the end of pipe.

36. REINFORCED CONCRETE HEADWALLS

36.1 General: Under this Item, the Contractor shall construct reinforced concrete headwalls on both the upstream and downstream faces of culverts.

36.2 Work Included: Under this Item the Contractor shall furnish all material, labor, and equipment required to construct and maintain reinforced concrete headwalls on both the upstream and downstream faces of culverts as shown on the plans, specified or directed by the Engineer. The work shall include, but not be limited to: excavation and grading to facilitate installation of the headwalls, concrete formwork, steel reinforcement, and concrete work.

36.3 Payment: The unit price bid per reinforced concrete head wall for Item 36 constructed, accepted, satisfactorily placed and maintained shall be compensation in full for the work of constructing the reinforced concrete

headwalls as shown on the plans, as specified, or as directed by the Engineer. Payment will be made based on the actual number of reinforced concrete headwalls constructed, accepted, satisfactorily placed and maintained.

37. STORM MANHOLES

37.1 General: Under this Item the Contractor shall install storm manholes at the locations shown on the Contract Drawings.

37.2 Work Included: The Contractor shall furnish all labor, materials, equipment required to install storm manholes as shown, specified or directed. Included is the base, the barrel section, slab top, reinforcing steel, tile weeps, the brick adjusting courses, the frame and cover, and the setting and adjustment necessary of the frame and grate to the design elevation. Also included is excavation lining material, dewatering (as required) and sheeting and bracing as ordered.

Storm Manhole Schedule:

SMH 1	4' diameter	frame and grate
SMH 2	5' diameter	frame and solid cover
SMH 3	5' diameter	frame and solid cover

37.3 Payment: The unit price bid per storm manhole for Item 37 constructed, accepted, satisfactorily placed, and maintained shall be compensation in full for the work of constructing storm manholes as shown on the plans, as specified or as directed by the Engineer. Payment will be made based on the actual number of each size storm manhole constructed, accepted, satisfactorily placed, and maintained.

38. DUMPED RIP-RAP

38.1 General: Under this Item the Contractor shall install rip rap where shown on the Contract Drawings or ordered.

38.2 Work Included: The Contractor shall furnish all labor, materials, equipment and services required to install the required ditch rip-rap to the lines and grades shown on the Contract Drawings, ordered or specified. The work shall include 6 inches of bedding material and necessary subgrade excavation.

38.3 Payment: The unit price bid per cubic of dumped rip-rap bid for Item 38 shall constitute payment in full for furnishing, installing, and maintaining the select fill for the duration of this project. Payment will be made based on the actual number of cubic yards of rip-rap including bedding installed, measured in place upon completion of work, as shown on the Contract Drawings, ordered or specified.

39. MISCELLANEOUS SELECT FILL

39.1 General: Under this Item the Contractor shall furnish and place miscellaneous select fill not included in other Items of this Contract.

39.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and services required to place miscellaneous select fill not included under other Items of this Contract ordered placed by the Engineer. The work shall include, but not be limited to: purchasing, loading, transporting, delivery to site, unloading, and placing and compacting select fill from off site to the required lines and grades; obtaining necessary mining and hauling permits; sampling and testing all sources of select fill for compliance with material requirements; compacting to the specified moisture content and density. Select fill included under this payment Item includes:

Type A
Type B
Type C
Type D
Type E
Type F
Type G
Type H
Type I

39.3 Payment: The unit price bid per cubic yard of select fill for Item 39 shall constitute payment in full for furnishing, installing, and maintaining the select fill during the duration of this project. The quantity of miscellaneous select fill materials for pipeline installation for which payment will be as ordered by the Engineer and will be computed by using the payment dimensions as defined in the plans, without regard to the actual dimensions and quantity of the materials in place.

The quantity of miscellaneous select fill, including materials below subgrade for structures, for which payment will be made will be the actual number of cubic yards measured in-place for each material furnished and placed as ordered by the Engineer.

40. MISCELLANEOUS CONCRETE

40.1 General: Under this Item, the Contractor shall furnish and place miscellaneous concrete not included in other Items of this Contract. Miscellaneous concrete shall have a minimum 28 day compressive strength of 4,000 pounds per square inch (PSI).

40.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to install miscellaneous concrete for bedding, curbing, encasements, headwalls, or elsewhere which is not shown or specified to be included under other Items of this Contract. Structural concrete is not included under this Item.

40.3 Payment: The quantity of miscellaneous concrete (minimum 28 day compressive strength of 4,000 PSI) for which payment will be made under Item 40 will be the actual number of cubic yards of such concrete place in the work as ordered by the Engineer, measured in place within the payment limits as defined or specified.

41. DETENTION BASINS

41.1 General: Under this Item the Contractor shall excavate, construct and maintain during construction all detention basins shown on the Drawings and specified.

41.2 Work Included: Under this Item the Contractor shall furnish all labor, materials, equipment and disposal services required to construct and maintain in a working manner during construction, the stormwater detention basins as illustrated on the drawings or directed by the Engineer.

41.3 Payment: The lump sum bid price for constructing and maintaining the detention basins shall be compensation in full for the work required by Item 40.

42. SHALLOW GROUND WATER RECOVERY WELLS

42.1 General: Under this Item, the Contractor shall construct and maintain during construction, shallow ground water recovery wells at the locations as shown on the plans as specified, and as directed by the Engineer.

42.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to construct and maintain during construction shallow ground water recovery wells at the locations shown on the plans and as specified. The work shall include, but not be limited to, drilling a minimum 12 inch diameter borehole four feet into bedrock; installation of a 6 inch diameter stainless steel (s.s.) well screen, 6 inch stainless steel riser, gravel pack, bentonite seal and bentonite cement grout. Under this Item, the Contractor shall maintain the shallow ground water recovery wells during the duration of the Contract.

42.3 Payment: The unit price bid per well based upon a depth of 40 vertical linear feet (VLF) measured from the bottom of the well screen located four feet into bedrock, to the flange at the top of the well shall be compensation in full for constructing and maintaining during construction at the locations and as shown on the Plans and as specified. Reference Item 43 "ADD OR DEDUCT PER VLF OF SHALLOW GROUND WATER RECOVERY WELLS". If the shallow ground water recovery wells measures greater than or less than 40 VLF, the difference shall be made under Item 43.

43. ADD OR DEDUCT PER VLF OF SHALLOW GROUND WATER RECOVERY WELL

43.1 General: Under this Item, the Contractor shall provide or receive compensation for the difference between the 40 VLF depth used to estimate the base depth for the shallow ground water recovery wells. The difference is the actual depth drilled either less than or greater than 40 VLF. The shallow ground water recovery wells shall be installed as shown on the Plans and as Specified.

43.2 Work Included: Under this Item, the Contractor shall provide or receive compensation for the difference between the 40 VLF base depth estimated for the shallow ground water recovery wells. The difference will be the actual depth drilled compared to the base depth of 40 VLF. The work shall include, but not be limited to, drilling a minimum 12 inch diameter borehole; installation of 6 inch diameter stainless steel (s.s.) well screen, 6 inch

stainless steel riser and gravel pack. Drilling into bedrock is not included in this Item. Drilling into bedrock will be paid for under Item 42.

43.3 Payment: The unit price bid per vertical linear foot (VLF) of shallow ground water recovery well less than or greater than the 40 VLF base depth shall be compensation in full for installation of shallow ground water recovery well less than or greater than the 40 VLF base depth. Reference Item 42 "SHALLOW GROUND WATER RECOVERY WELLS" for a description of the payment for the 40 VLF base depth.

44. SHALLOW GROUND WATER COLLECTION SYSTEM

44.1 General: Under this Item, the Contractor shall furnish, install, and maintain the ground water collection system. This Item includes work to within five feet of Tank 101 as shown on the plans and specified.

44.2 Work Included: The work included under this Item includes all labor, material, equipment, and services necessary for, and incidental to, construction of the shallow ground water collection system. This includes, but is not limited to:

Submersible well pumps, motors, pump motor cables, and level transmitters;

Air vacuum release valves, manual sample taps, pressure gauges, s.s. check valves, s.s. ball valves, and flow meters;

Precast concrete vaults, including excavation and 12" type F leveling courses, wall sleeves, and link seals, harnesses;

Air valve manholes, air release and vacuum valves, and air vents;

All piping and fittings associated with the shallow ground water collection system, including stainless steel piping and high density polyethylene (HDPE) forcemain, valve boxes, ductile iron risers, force main drain, and thrust blocks;

Trenching, installation, backfill, and compaction around below ground structures, piping and force mains as specified and as shown on the plans;

Electrical - This shall include providing and installing all electric service components associated with the ground water collection system, including but not limited to conduit, meters, and switches as specified and shown in the Plans.

44.3 Payment: The lump sum price bid for Item 44 shall be compensation in full for the work of constructing the shallow ground water collection system.

45. GROUND WATER TREATMENT SYSTEM

45.1 General: Under this Item, the Contractor shall furnish, install, start-up and place into service the ground water treatment system as shown on the plans and as specified.

45.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to construct and place into service the ground water treatment system, as shown on the plans and as specified. The work shall include, but not be limited to:

- Site work including plant effluent outfall sewer, potable water service pipeline with fire hydrants and plant waste sewer
- Structural elements
- Architectural elements
- Process equipment
- Electrical, instrumentation and control systems
- Heating, ventilating, and air conditioning
- Plumbing including septic system
- System start-up and performance testing

The work of this Item shall include those facilities associated with the ground water treatment system located within the perimeter fence (except as specifically noted) of the ground water treatment system and gas extraction building area associated with the ground water treatment system.

45.3 Payment: The lump sum price bid for Item 45 shall be payment in full for the work of construction, start up and placing into service the ground water treatment system.

46. EFFECTIVENESS MONITORING SYSTEM

46.1 General: Under this Item, the Contractor shall construct and maintain during construction the wells and piezometers comprising the effectiveness monitoring system at the locations shown on the plans, as specified or directed by the Engineer.

46.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to construct the wells and piezometers at the locations shown on the plans and as specified.

- a. Installation of 2-inch diameter PVC piezometers including, but not limited to, drilling a 6-inch diameter borehole a minimum of four feet into bedrock, disposal of the cuttings, sealing of the bedrock borehole with a cement/bentonite grout, 2-inch diameter slotted PVC screen, sand pack, 2-inch diameter PVC riser pipe, bentonite slurry, concrete and protective concrete.
- b. Installation of 4-inch diameter PVC monitoring wells including, but not limited to, drilling a 8-inch diameter borehole a minimum of four feet into bedrock with a cement/bentonite grout, disposal of the cuttings, sealing of the bedrock borehole, 4-inch diameter slotted PVC screen, sand pack, 4 inch diameter PVC riser pipe, bentonite slurry, concrete and protective casing.

- c. Installation of 6 inch diameter PVC piezometers including, but not limited to, drilling a 10-inch diameter borehole a minimum of four feet into bedrock, disposal of the cuttings, sealing of the bedrock borehole with a cement/bentonite grout, 6-inch diameter slotted PVC screen, sand pack, 6-inch diameter PVC riser pipe, bentonite slurry, concrete and protective casing. Where the piezometer is installed through the landfill cover, this shall also include making the specified connections and seals to the synthetic liner and landfill cover.
- d. Installation of 6-inch diameter steel bedrock monitor wells including, but not limited to, drilling a 10-inch diameter borehole 10 feet into competent bedrock, drilling a 6-inch diameter open hole a minimum of 25 feet into bedrock, disposal of the cuttings, 6-inch diameter steel casing, cement/bentonite grout, concrete and protective casing.
- e. Installation of 6-inch diameter steel off-site bedrock monitor wells including but not limited to, drilling a 10-inch diameter borehole 10 feet into competent bedrock; pressure grouting the outer casing into the borehole, installing 6-inch diameter inner casing to the top of the open borehole interval geophysical logging of pilot holes, cement/bentonite grout, concrete and protective casing.

46.3 Payment:

The unit price bid per piezometer for the installation of 2 inch diameter PVC piezometers based upon an assumed length of 40 lineal feet measured from the bottom of the piezometer screen to the top of the well shall be compensation in full for the installation of 2-inch diameter piezometers.

The unit price bid per well for the installation of 4 inch diameter PVC monitor wells based upon an assumed length of 35 lineal feet measured from the bottom of the well screen to the top of the well shall be compensation in full for the installation of 4-inch diameter monitoring wells.

The unit price bid per piezometer for the installation of 6-inch diameter PVC piezometers based on an assumed length of 70 lineal feet measured from the bottom of the piezometer screen to the top of the piezometer shall be compensation in full for the installation of 6 inch diameter piezometers.

The unit price bid per well for the installation of 6-inch diameter steel bedrock monitor wells based upon an assumed length of 75 lineal feet measured from the bottom of the open borehole to the top of the well shall be compensation in full for the installation of 6-inch diameter bedrock monitoring wells.

The unit price bid per well for the installation of 6-inch offsite, bedrock monitor wells based upon assumed lengths of 100, 150 and 200 ft. for the shallow, intermediate and deep wells, respectively measured from the bottom of the open borehole to the top of the well shall be compensation in full for the installation of 6-inch offsite bedrock monitor wells.

Reference Item 47. "ADD OR DEDUCT PER VLF OF EFFECTIVENESS MONITORING SYSTEM". If the piezometers or wells of the Effectiveness Monitoring System measure greater than or less than the assumed length, the difference shall be made under Item 47.

47. ADD OR DEDUCT PER VLF OF EFFECTIVENESS MONITORING SYSTEM

47.1 General: Under this Item the Contractor shall provide or receive compensation for the difference between the assumed average depths used as an estimate for the piezometers and wells in the effectiveness monitoring system and the actual length of well installed. The piezometers and wells of the effectiveness monitoring plan are to be as shown on the plans, as specified, or as directed by the Engineer.

47.2 Work Included: Under this Item the Contractor shall provide or receive compensation for the difference between the assumed average depths used as an estimate for the piezometers and wells in the effectiveness monitoring system and the actual length of well installed. The difference is the depth of the bottom of the well drilled compared the assumed average depth. The assumed average depths are as follows:

<u>Description</u>	<u>Assumed Average Depth</u>
2-inch diameter PVC piezometers	40 feet
4-inch diameter PVC monitoring wells	35 feet
6-inch diameter PVC piezometers	70 feet
6-inch diameter steel monitoring wells (bedrock)	75 feet
6-inch diameter steel off-site bedrock monitoring wells	100 feet
6-inch diameter steel off-site bedrock monitoring wells	150 feet
6-inch diameter steel off-site bedrock monitoring wells	200 feet

The work shall include, but not be limited to , on-site disposal of fill/refuse material encountered during drilling and constructing the boreholes of the required diameters, installation of piezometers or well screen as required, installation of the required diameter PVC riser, and installation of the gravel pack. Drilling into bedrock for the 2-inch diameter PVC piezometers, 4-inch diameter PVC monitor wells, and 6-inch diameter PVC piezometers is not included in this Item. Drilling into bedrock for the 2-inch diameter PVC piezometers, 4-inch diameter PVC monitor wells, and 6-inch diameter PVC piezometers will be paid for under Item 46.

Drilling to bedrock beyond the depth of 35 feet for the off-site bedrock wells is included in this Item. Drilling of the first 35 feet of bedrock for the bedrock wells is included under Item 46.

47.3 Payment: The unit price bid per vertical linear foot (VLF) of effectiveness monitoring system piezometer or monitoring well less than or greater than the assumed average depth for the particular diameter monitoring well or piezometer shall be compensation in full for installation of effectiveness monitoring system piezometer or monitoring well less than or greater than the assumed average depth for the particular diameter monitoring

well. Reference Item 46 for a description of the payment for the assumed average depth.

48. GROUTING EXISTING MONITORING WELLS

48.1 General: Under this Item, the Contractor shall grout and seal existing monitoring wells as shown on the plans and as specified.

48.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment and services necessary to grout and seal existing wells as shown on the Plans and as specified in N.J.S.A. Subchapter 9, Sealing of Abandoned Wells, Section 7.9 -9.1 through 9-9.4.

48.3 Payment: The unit price bid per vertical linear foot (VLF) of grouted well, measured from the bottom of the well to the ground surface shall be compensation in full for the grouting of the wells as shown on the Plans.

49. EROSION AND SEDIMENT CONTROL

49.1 General: Under this Item, the Contractor shall develop a site specific soil erosion and sediment control plan as specified. Also under this Item, the Contractor shall implement the soil erosion and sediment control plan during construction.

49.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment and services necessary to develop and implement a site specific erosion and sediment control plan as specified. Development of the site specific erosion and sediment control plan shall include, but not be limited to, obtaining required permits, and obtaining approval of the site specific erosion and sediment control plan from the Morris County Soil Conservation District (SCD). Implementation of the site specific erosion and sediment control plan during construction shall be in accordance with the approved site specific erosion and sediment control plan, the specifications and as directed by the Engineer.

49.3 Payment: The lump sum price bid for Item 49 shall be compensation in full for the development and implementation of the site specific erosion and sediment control plan.

50. CHAIN LINK FENCE

50.1 General: Under this Item, the Contractor shall furnish, install, and maintain during construction, an 8 foot high chain link fence topped with one foot of barbed wire as shown on the Plans, specified, or directed by the Engineer.

50.2 Work Included: Under this Item, the Contractor shall furnish all labor, materials, equipment, and services required to install and maintain during construction the 8 foot high galvanized steel chainlink fence topped with three strands barbed wire. The work shall include, but not be limited to: necessary grading of the fenceline excavation for the fence posts; concrete for anchoring the fence and gate posts; 8 foot high galvanized steel chain link fabric welded to fence posts; 1-ft high, three strand barbed wire with extension arms; posts, rails, tension wires, and braces; stretcher bars; ties or clips; 1 double leaf gate with two fifteen foot sections for a total width

of 30 feet, 2 double leaf gates each with two ten foot sections for a total width of twenty feet each, and 2 double leaf gates each with two six foot sections for a total width of twelve feet each; gate padlock for each double swing gate; warning signs along the fence perimeter.

50.3 Payment: The unit price bid per linear foot of fence installed shall constitute payment in full for furnishing, installing, and maintaining the 8 foot high chain link fence during the duration of this contract.

51. DECONTAMINATION AREA AND FACILITIES

51.1 General: Under this Item, the Contractor shall construct and operate a decontamination area and associated facilities in accordance with the plans, specifications, approved decontamination protocol, and applicable codes, standards, and regulations.

51.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and services required to construct and operate a decontamination area and associated facilities at the Combe Fill South Landfill. The work of this Item shall include, but not be limited to, construction of an equipment decontamination pad, establishment of a personnel decontamination facility, and the operation during construction of the decontamination pad and the personnel decontamination facility. Water generated during decontamination procedures shall be collected and disposed of in accordance with the construction water and contaminated water management plans.

51.3 Payment: The lump sum price bid for Item 51 shall be compensation in full to construct and operate the decontamination area and facilities in accordance with the plans, specifications, approved decontamination protocol, applicable codes, standards, and regulations. Disposal of construction water generated during decontamination shall be paid for under Item 7.

52. AIR MONITORING PLAN

52.1 General: Under this Item, the Contractor shall prepare, submit, and implement an Air Monitoring Plan in accordance with requirements contained in Section 01110 - Safety, Health, and Emergency Response.

52.2. Work Included: Under this Item, the Contractor shall furnish all labor, materials, and services required for preparing submitting and implementing the Air Monitoring Plan described in Part 3.06 of Section 01110 - Safety, Health, and Emergency Response. The remainder of work required for Section 01110 - Safety, Health, and Emergency Response is paid for under other Items.

52.3 Payment: The lump sum bid price for Air Monitoring Plan Development shall be compensation in full for the work of preparing the Air Monitoring plan and shall be payable upon acceptance of the Air Monitoring Plan. The lump sum bid price for Air Monitoring Plan Implementation shall be compensation in full for the work of implementing the Air Monitoring Plan. Payments for the implementation of the Air Monitoring Plan will be made in equal monthly installments from the Notice to Proceed. The equal monthly installments shall be based on the time remaining following the Notice to Proceed utilizing the contract duration contained in the Contract Documents. Air monitoring requirements may be discontinued, at the discretion of the

Engineer and Construction Manager when the gas treatment system is activated. If this occurs, the balance of the lump sum for implementation of the Air Monitoring Plan will be payable. The price bid for additional testing of sorbent tubes as directed by the Engineer shall be payment in full for testing of tubes beyond that required in Section 01110 - Safety, Health, and Emergency Response. The quantity measured shall be the actual number of tubes tested.

53. DUST MIGRATION CONTROL PLAN

53.1 General: Under this Item, the Contractor shall prepare, submit, and implement a Dust Migration Control Plan in accordance with Requirements contained in Section 01100 - Special Project Procedures.

53.2 Work Included: Under this Item, the Contractor shall furnish all labor, material, and services required for preparing, submitting, and implementing the Dust Control Plan described in Section 01110 - Special Project Procedures.

53.3 Payment: The lump sum bid price for Dust Migration Control Plan Development shall be compensation in full for the work of preparing the Dust Migration Control Plan and shall be payable upon acceptance of the Dust Migration Control Plan. The lump sum bid price for Dust Migration Control Plan Implementation shall be compensation in full for the work of implementing the Dust Migration Control Plan. Payment for the implementation of the Dust Migration Control will be made in equal monthly installments from the Notice to Proceed. The equal monthly installments shall be based on the time remaining following the Notice to Proceed utilizing the contract duration contained in the Contract Documents.

54. ENVIRONMENTAL POLLUTION CONTROL PLAN

54.1 General: Under this Item, the Contractor shall prepare and submit an Environmental Pollution Control Plan in accordance with Requirements contained in Section 01100 - Special Project Procedures and Section 01120 - Environmental Protection.

54.2 Work Included: Under this Item, the Contractor shall furnish all labor, material, and services required for preparing and submitting the Environmental Pollution Control Plan described in Section 01100 - Special Project Procedures and Section 01120 - Environmental Protection.

54.3 Payment: The lump sum bid price for Environmental Pollution Control Plan Development shall be compensation in full for the work of preparing the Environmental Pollution Control Plan. No additional payment will be made for implementing the Environmental Pollution Control Plan.

55. SPILL AND DISCHARGE CONTROL PLAN

55.1 General: Under this Item, the Contractor shall prepare and submit a Spill and Discharge Control Plan in accordance with requirements contained in Section 01100- Special Project Procedures and Section 01130- Spill and Discharge Control

2. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, or any stream corridors;
3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors, or any wetlands;
4. Damaging vegetation outside of the work area;
5. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.
6. Permanent or unspecified alteration of any streams;
7. Open burning of any debris;
8. Location of storage stockpiles in environmentally sensitive areas;
9. Disposal of excess or unsuitable excavated material in wetland or floodplains even with permission of the property owner.

1.06 NOISE CONTROL

- A. Noise control shall be accomplished by restricting the amount of machinery in operation to only that necessary to complete the work, using adequate mufflers to all applicable equipment, and limiting construction activities to daylight hours when possible.

1.07 DUST CONTROL

- A. The Contractor shall maintain all excavations, embankments, stockpiles, access roads, waste areas, borrow areas, and all other work areas free from excess dust to such reasonable degree as to avoid causing nuisances. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

1.08 WARRANTY PERIOD

- A. The Contractor shall provide a minimum warranty period of one year unless otherwise stated in the technical specifications.

1.09 FILL/REFUSE RELOCATION

- A. The work of this Contract requires the relocation of fill/refuse from outside the limits of capping to within the limits of capping in accordance with the plans and specifications. Areas in which fill/refuse is to be relocated are shown on the plans. Fill/Refuse relocation is to be accomplished in accordance with Section 02229 - Fill/Refuse Relocation.

- Transportation and temporary on-site storage in the staging area until disposal is arranged by the State or disposal in the fill if so directed by the Construction Manager;

Sampling required for off-site disposal and off-site disposal is not included in this Item. These tasks will be undertaken by the State.

59.3 Payment: The unit price bid per drum removed from shall be compensation in full for Drum Removal. The quantity measured shall be the actual number of drums for which a disposal analysis is conducted.

60. OPERATION AND MAINTENANCE - FIRST YEAR

60.1 General: Under this Item, the Contractor shall operate and maintain the landfill and associated systems for 12 month period beginning at the date of substantial completion.

60.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and equipment required to operate and maintain the closed landfill and associated systems for a 12 month period beginning at the date of substantial completion. This work shall include, but not be limited to:

- Site maintenance, including site access;
- Operation and maintenance of the gas collection and treatment system;
- Operation and maintenance of the ground water collection and treatment system;
- Maintenance required by the O&M Manual;
- Health and safety requirements;
- Medical monitoring;
- Power requirements and telephone service;
- Preparation and submittal of reports and records;

60.3 Payment: The lump sum price for Operation and Maintenance for the first Year following substantial completion shall be compensation in full for the Operation and Maintenance during the first year following substantial completion. Payment will be made in twelve equal monthly installments.

61. OPERATION AND MAINTENANCE - SECOND YEAR

61.1 General: Under this Item, the Contractor shall operate and maintain the landfill and associated systems for 12 month period beginning at the date of substantial completion.

61.2 Work Included: Under this Item, the Contractor shall furnish all labor, equipment, materials, and services required to operate and maintain the closed landfill and associated systems for a 12 month period beginning at the

date of substantial completion. This work shall include, but not be limited to:

- Site maintenance, including site access;
- Operation and maintenance of the gas collection and treatment system;
- Operation and maintenance of the ground water collection and treatment system;
- Maintenance required by the O&M Manual;
- Health and safety requirements;
- Medical monitoring;
- Power requirements and telephone service;
- Preparation and submittal of reports and records;

61.3 Payment: The unit price per month for Operation and Maintenance for the Second Year following substantial completion shall be compensation in full for the Operation and Maintenance during the Second Year following substantial completion. The State may cancel this Item, or any part thereof, with 30 day notice.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used

- END OF SECTION -

SECTION 01020
SPECIAL PROVISIONS

1.01 QUANTITIES AND AMOUNTS OF WORK

- A. The Contractor shall furnish all plant, materials, labor, transportation, fuel, power, and water necessary to complete the work under this contract properly, in accordance with the specifications and plans therefore, at the agreed unit and lump sum prices.
- B. The work under this contract shall be completed, and all work, materials, and services not expressly called for in the specifications, or not shown on the plans, which are necessary and required for the proper construction and operation of the items of work and equipment specified and shown, shall be performed, furnished, and installed by the contractor at the agreed unit and lump sum prices, at no additional cost to the State.
- C. The lump sum and unit prices bid shall constitute full compensation for all work completed under the Contract, except for any additional work ordered by the State and issued to the Contractor in the form of a written order by the State.
- D. Changes in the work requiring more or less of the items for which unit prices are set forth in the Contract may be made upon a written change order. When changes result in the use of more of the unit price items than shown on the plans and specified, payment will be made in accordance with the unit prices in the Contract. When the changes result in the use of less of the unit price items than shown on the Plans and specified, deductions will be made in accordance with the said unit prices.

1.02 LINES, GRADES, AND ELEVATIONS

- A. The State will provide baselines or principal centerlines together with a benchmark to establish reference points which, in the judgement of the State are necessary to proceed with the work.
- B. From this information, the Contractor shall verify bench marks and develop and make all detail surveys needed for construction.
- C. The Contractor shall set and maintain all necessary intermediate points, lines, grades and elevations, and provide slope stakes, offset stakes, batter boards, stakes for pipe locations, and other such items at his own expense. Where the Contractor uses a laser for control, he shall periodically check the grade and alignment during each days operation.
- D. The accuracy of the Contractor's survey and other required data is the sole responsibility of the Contractor, and the furnishing

of data to the State, Construction Manager, or Engineer does not constitute a transferral of responsibility for checking.

1.03 SUPPLEMENTAL INFORMATION

- A. Chemical data on ground water and soil at and near the site, and the results of test pits and soil borings conducted for purposes of design are available for inspection by bidders at the Division of Hazardous Site Mitigation, 401 E. State Street, Trenton, New Jersey 08625.
- B. It shall be the Contractor's obligation to satisfy himself as to the nature, character, quality and quantity of subsurface conditions likely to be encountered. Any reliance upon the subsurface information and chemical data made available by the State or the Engineer shall be at the Contractor's risk. The Contractor agrees that he shall neither have nor assert against the State or Engineer any claim for damages for extra work or otherwise or for relief from any obligation of this Contract based upon the failure by the State or Engineer to obtain or to furnish additional subsurface or chemical information or to furnish all subsurface or chemical information in the State's or Engineer's possession or based upon any inadequacy or inaccuracy of the information furnished; provided, however that the Contractor may be entitled to an adjustment in the contract price under the circumstances and to the extent provided in the General Conditions.
- C. Certain subsurface and chemical information may be shown on separate sheets or otherwise made available by the State or Engineer to Bidders, Contractors, and other interested parties. Neither such information nor the documents on which it may be shown shall be considered a part of the Contract Documents or Contract Drawings, it being understood that such information is made available only as a convenience, without express or implied representation, assurance, or guarantee that the information is adequate, complete, or correct, or that it represents a true picture of the subsurface and chemical conditions to be encountered, or that all pertinent subsurface information and chemical data in the possession of the State or Engineer has been furnished.
- D. Any holder of Contract Documents will be permitted to make test borings, test pits, soundings, etc., on the site of the Work if he so desires subject to his first obtaining approval from the State. It is understood that the part or parties receiving such approval must assume all risks and liabilities contingent thereto.
- E. It shall be the obligation of the Contractor to inquire of the State and Engineer whether pertinent subsurface information has been obtained by the State with respect to the work.

1.04 TEMPORARY FACILITIES AND CONTROLS

- A. The Contractor shall provide, at his own expense, all temporary facilities and controls required for the work and shall include, but not be limited to :
 - 1. Temporary utilities such as heat, water, lighting, electrical energy, and telephone;
 - 2. Sanitary facilities;
 - 3. Enclosures such as tarpaulins, barricades, and canopies as needed or required;
 - 4. Fencing of construction area, if required or necessary
 - 5. Haul roads, traffic barricades;
 - 6. Construction water storage and disposal facilities.
- B. The wiring for temporary electric lights and power shall be installed and maintained in a first class manner. Electric wires shall be kept thoroughly insulated and special precautions shall be taken to avoid short circuits, using insulated wire and weather - proof sockets and fittings throughout. The Contractor shall supply electric service from the temporary system to the Engineer's and Contractor's field offices, with characteristics as required.
- C. The Contractor shall make all arrangements for this system with Jersey Central Power and Light Company. The Contractor shall pay all charges, fees, etc., directly to the utility company.
- D. The cost of providing temporary power and lighting shall be included in the Contractor's price for Operation and Maintenance of Temporary Facilities.
- E. The Contractor shall protect the work at all times from the harmful effects of extreme low or high temperatures;
- F. The Contractor shall arrange with the local telephone company for all telephone service required by the Contractor, the State office and the Engineer's office in the performance of the work of this Contract. Telephone service costs shall be included in the Contractor's bid price for this Contract.

1.05 PROHIBITED CONSTRUCTION PROCEDURES

- A. Prohibited construction procedures shall include, but not be limited to, the following :
 - 1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters, or at any unspecified or unapproved locations;

- B. The Contractor shall be aware fill/refuse relocation is to be accomplished underneath the Jersey Central Power and Light (JCPL) right of way (ROW) which crosses the Combe Fill South Site. The landfill cap is to extend across the ROW between NJPL towers 167 and 40 . In this area, fill/refuse relocation is necessary only to the depth necessary to facilitate installation of the landfill cap, including one foot of embankment material, a total depth of approximately six feet. The Contractor shall further be aware that if refuse encountered in the JCPL ROW is relatively thin, the State may elect, at its discretion, to require the Contractor to relocate all the fill/refuse in all or a portion of the area of the JCPL ROW to be capped, and eliminate capping in all or a portion of this area. Final grades in this area shall not exceed those which currently exist. The Contractor shall be responsible for determining and complying with all requirements for working in the JCPL ROW.
- C. In other areas requiring fill/refuse relocation from outside the limits of capping to within the limits of capping, the Contractor shall remove the entire thickness of fill/refuse, as directed by the Engineer.

1.10 ON-SITE GEOTECHNICAL LABORATORY

- A. The on-site geotechnical laboratory to be provided and operated by the Contractor during construction shall be available for inspection by the Engineer and State at all times during the completion of this Contract. The Contractor shall supply the State and the Engineer with correction factors for nuclear density meters used for testing in accordance with ASTM D2922-81. The Contractor shall also provide for off-site testing laboratory necessary to obtain material approval prior to establishment of on-site laboratory, coverage of equipment breakdown and temporary exceedance of on-site laboratory capacity. The off-site laboratory shall be utilized only with the approval of the Engineer.

1.11 PROJECT PHOTOGRAPHS

- A. The Contractor shall provide a minimum of twenty four (24) 8 inch x 10 inch glossy color photographs and mounted color slides per week during construction of the project. The Contractor shall also provide a minimum of thirty six (36) 8 inch x 10 inch glossy color photographs and mounted color slides prior to any construction activities, and at the completion of construction. Photographs shall be taken from locations to illustrate conditions of the work and the state of progress. At successive periods of photography, at least one photograph shall be taken from the same overall view as previously used.
- B. The Contractor shall consult with the Engineer during each period of photography for instructions concerning views required.

- C. The color prints shall be inch x 10 inch printed on single weight paper with a glossy, smooth surface. Each print shall be identified on the back. Identification is to include:
- Name of the project
 - Orientation of the view
 - Date and time of the exposure
 - Photographer's numbered identification of the exposure
- D. Slides shall be color and taken with a 35 mm camera. Each slide shall be identified by a number on the slide. A corresponding field book shall be provided listing the following:
- Number of slide
 - Name of the project
 - Orientation of the view
 - Date and time of the exposure

1.12 REFERENCES TO GENERAL CONDITIONS

References in the Specifications to "General Provisions", "General Requirements", and "General Conditions", shall all be taken to refer to the "General Conditions" section of the Specifications.

1.13 ADDITIONAL DEFINITIONS

The following terms shall be defined as follows:

Fill/Refuse: Fill/Refuse shall be defined as any non-native materials located at the site, including but not limited to household waste, industrial waste, construction demolition, debris and associated cover soil.

Construction Water: Construction water shall be defined as surface water which has come into contact with refuse, all ground water discharged from excavations in fill/refuse, and water generated from decontamination of equipment and other materials.

Landfill: The expressions "landfill", "landfill area", and "landfill closure area" shall define the area of refuse over which the cap system is to be constructed and the areas in which fill/refuse is currently in place.

Final Landfill Cover: Final landfill cover shall be defined as the extent of the multilayered cover as shown on the plans, as specified or as directed, including the soil barrier layer, flexible membrane cover (where present), filter fabric, drainage layer, vegetative layer and topsoil layer.

Excavation (or Trenching):

Excavation (or trenching) shall be defined as the following:

- Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for

all purposes of the construction and completion of all the work under Construction;

- All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removal of the same;
- All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, wellpointing or otherwise controlling water;
- The removing and disposing of all surplus materials from the excavations in the manner specified;
- The maintenance, accommodation and protection of travel and the temporary paving of highways, roads and driveways;
- The supporting and protection of all tracks, rails, buildings, curbs, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury;
- All temporary bridging and fencing and the removing of same.

Earth: Earth shall be defined as all materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, and roots or pieces of timber, soft or disintegrated rock, ledge or bedrock and individual boulders or masonry.

Backfill: Backfill shall be defined as the refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

Spoil: Spoil material shall be defined as surplus excavated materials not required or not suitable for backfills or embankments.

Embankments: Embankments shall be defined as fills constructed above the original surface of the ground or such other elevation as specified or directed.

Limiting Subgrade: Limiting subgrade shall be defined as the bottom of the pipe embedment for pipelines or the underside of footing lines or mudmats for structures.

Excavation Below Subgrade: Excavation below subgrade shall be defined as the following:

- Excavation below the limiting subgrades of structures or pipelines.

- Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required
- The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

1.14 CONTAMINANT LEVELS IN OFF-SITE BORROW SOURCES MATERIAL

- A. Materials to be brought on site shall not contain contaminants in excess of the following concentrations. If these concentrations are exceeded the determination as to whether the materials are acceptable for the intended use shall be made by the State.

Parameter	Total concentration (ppm or mg/kg)
<u>Organics</u>	
Total Volatiles	1
Total PCBs	1
Total carcinogenic PAHs	10
Total pesticides	2
<u>Inorganics</u>	
Antimony	10
Arsenic	20
Barium	600
Beryllium	1
Cadmium	3
Chromium	100
Copper	600
Lead	250
Mercury	1
Molybdenum	1
Nickel	100
Selenium	4
Silver	5
Thallium	5

Parameter	Total concentration (ppm or mg/kg)
Vanadium	100
Zinc	1000

- B. Source of materials shall be subject to approval by the Engineer.

1.15 ADDITIONAL SURVEY AND TOPOGRAPHIC MAPPING

The Contractor shall be aware that subsequent to the award of the Contract, but prior to fill/refuse relocation, the Engineer will be preparing a new survey and topographic mapping of the Combe Fill South Landfill. This work is being undertaken to account for settlement of the refuse which may have occurred since the mapping utilized to prepare the plans was completed in 1989. As a result of the new mapping, the engineer will be preparing new final grading plans to account for settlement. The new grading plans may also result in modifications to geomembrane coverage and piping locations, particularly those associated with the gas collection system. New drawings will be issued by the Resident Engineering Firm to the Contractor will be made under the appropriate unit price items.

1.16 SHOP DRAWINGS AND SUBMITTALS

The Contractor shall submit eight (8) copies of all required shop drawings and submittals in accordance with requirements in the General Conditions.

PART 2 PRODUCTS

- A. Not Used.

PART 3 EXECUTION

- A. Not Used.

- END OF SECTION -

SECTION 01100
SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All work required to submit the necessary information, as specified herein, to the Engineer and State Construction Manager within 28 calendar days after contract award.

B. Related Work Specified Elsewhere

1. Summary of Work: Section 01010
2. Safety Health and Emergency Response: Section 01110
3. Environmental Protection: Section 01120
4. Contractor Quality Control: Section 01400
5. Construction Water Management: Section 01125
6. Spill and Discharge Control: Section 01130
7. Site Specific Erosion and Sediment Control Plan: Section 02273

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. Not Used.

1.03 SUBMITTALS

- A. Special Project Procedure Plans
- B. Air Monitoring Plan
- C. Dust Migration Control Plan
- D. Spill and Discharge Control Plan
- E. Environmental Pollution Control Plan
- F. Quality Control Plan
- G. Security Plan

PART 2 - PRODUCTS

2.01 SPECIAL PROJECT PROCEDURE PLANS

- A. The Contractor shall prepare the special project procedure plans. These special project procedure plans, once approved and complete with all comments addressed, shall be made a part of the Contract Documents, prior to the State issuing a Notice to Proceed with the work related to the special project procedure.
- B. Approval of these special project procedure plans by the Engineer and Construction Manager is a prerequisite for project start up. The Engineer and Construction Manager, at their discretion, may give consideration to accept partial submittals. However, the submittal must be approved prior to implementation of any activity pertaining to that submittal. The Contractor shall implement and maintain these special project procedures at the appropriate time prior to and during performance of work.

2.02 SAFETY, HEALTH, AND EMERGENCY RESPONSE

- A. A Safety, Health, and Emergency Response Plan (SHERP) shall be submitted which shall include delineation of site work areas and the appropriate levels of personnel protection, specifications of personnel training operations, medical surveillance requirements, emergency and first aid equipment requirements, accident prevention, activity hazard analysis, and emergency response plans. The State may give consideration to approve portions of the SHERP pertaining to site setup activities.

2.03 AIR MONITORING PLAN

- A. An Air Monitoring Plan shall be submitted as part of the Safety, Health, and Emergency Response Plan and shall include delineation of site work areas and the necessary continuous on-site area, personnel, and perimeter air monitoring requirements.

2.04 DUST MIGRATION CONTROL PLAN.

- A. The Contractor shall prepare this plan describing site procedures to minimize the creation and dispersion of dust during construction activities.

2.05 SPILL AND DISCHARGE CONTROL PLAN

- A. The Contractor's Spill and Discharge Control Plan shall outline preventive measures as well as mitigative actions in the case of spills during the project work.

2.06 ENVIRONMENTAL POLLUTION CONTROL PLAN

- A. The Contractor's Environmental Pollution Control Program shall outline his procedures for minimizing the pollution of air, water, and land and controlling noise and the disposal of trash

and debris. The plan shall be submitted to the Engineer/Construction Manager for approval.

2.07 CONSTRUCTION WATER MANAGEMENT PLAN

- A. The Contractor shall present his procedures for construction water management. The plan shall be submitted to the Engineer/Construction Manager for approval.

2.08 GENERAL SITE WORK PLAN

- A. The Contractor shall submit a Plan of Operation detailing his planned construction sequence.

2.09 SITE SPECIFIC EROSION AND SEDIMENT CONTROL PLAN

- A. The Contractor shall prepare and submit this plan presenting operations to be performed by the Contractor to control sediment and minimize erosion of soils into drainage channels and lands adjacent to or affected by the work. The Contractor shall submit his erosion and sedimentation plan to the Morris County Soil Conservation District, pay the required fee and obtain certification of the plan by the Morris County Soil Conservation District. The Contractor must comply with all components of the certified plan during construction. The Contractor shall submit two (2) copies of the certified plan to the State and two (2) copies of the certified plan to the Engineer for review prior to implementation.

2.10 QUALITY CONTROL PLAN

- A. The Contractor shall submit a Quality Control plan detailing Quality Control Activities to be performed by the Contractor.

2.11 SECURITY PLAN

- A. The Contractor's Security Plan shall outline security measures to be implemented during construction.

2.12 COMMUNITY RELATIONS MEETING

- A. Contractor is required to participate in community relations related activities.
- B. Contractor shall include, in his overhead, provision for attending periodic meetings/site visits/local briefings and for the effort and time involved in preparation for these meetings. A formal public meeting will be held at the outset of the project. There will also be at least one health and safety meeting with local emergency response agencies. The Contractor shall also attend, at State's request, informal public information sessions to be held at least once per calendar quarter.

- C. Listed below is the State's Community Relations Overview for project requirements.

1. Community Relations Overview

Primary community relations responsibilities assigned by contract will be performed by the Resident Project Representative (RPR) under strict supervision and direction by the State which will develop and implement the site-specific Community Relations Program throughout the duration of the project. Upon notification to proceed, the Construction Contractor will be called upon to assist in the presentation of information concerning remedial action implementation to municipal, county, state and federal officials, the news media, other governmental agencies and the general public.

2. Community Relations Deliverables

The Construction Contractor should be prepared to present and discuss technical activities involving the construction project to a lay audience at the request of the State and upon notification to proceed. This may include, at a minimum, assisting the State and the RPR with the following:

a. Fact Sheets

These are usually two to three pages long and provide information about the activities and objectives related to the project. These fact sheets may describe construction goals, emergency management procedures, health and safety procedures, test and laboratory findings, scheduling, etc. A draft will be prepared by the RPR with assistance from the Construction Contractor. The State Community Relations staff will use this information to develop a final fact sheet to be distributed publicly.

b. Site Visits and/or Local Briefings

These will be scheduled by the State as needed to present information about remedial action implementation to local officials and the public. Primary responsibility will reside with the State and the RPR under State direction. The Construction Contractor will have a support role to attend and assist with specific information related to construction activity.

c. Public Information Sessions and/or Public Meetings

Formal Public Meetings may be required at this stage of the project, however, informal Public Information

Sessions using an open-house style are more common. Primary responsibility to conduct such meetings or sessions will reside with the State and the RPR under State direction. The Construction Contractor will have a support role to attend and assist with conveying to the attending public specific information related to construction activity.

d. Dress Rehearsal Meetings

A dress rehearsal meeting is held at the State offices for each public session planned (Site Visits, Local Briefings, Public Information Sessions and/or Public Meetings). Primary responsibilities will reside with the State and the RPR under State direction. The Construction Contractor will have a support role to attend and assist with specific information related to construction activity.

e. Information Requests

In general, all information requests from the public, elected officials and the media concerning the project should be referred to the State Construction Manager who will, in turn, refer them to the relevant State Community Relations Coordinator. If the State Construction Manager is not available, these requests should be referred directly to the relevant State Community Relations Coordinator (609- 984-3081). If the State Community Relations Coordinator is not available, these requests should be referred to the State Community Relations Chief (or Assistant Chief in the Chief's absence) at the same number or, for news media responses, to the NJDEP Press Office (609-292-2994 or 609-984-1795). This procedure should be used by the Construction Contractor's personnel if approached for information by residents, officials or news media either at the site or elsewhere during remedial action activities.

2.13 PROGRESS MEETINGS

- A. The Contractor shall schedule and administer progress meetings at a minimum of once per week and such additional meetings as required, if requested by the Engineer/Construction Manager.
- B. The Contractor shall administer the following general requirements for the progress meetings.
 - 1. Prepare agenda for meetings.
 - 2. Distribute written notice of each meeting four days in advance of meeting date.

3. Make physical arrangements for meetings.
 4. Preside at meetings.
 5. Record the minutes; include significant proceedings and decisions.
 6. Reproduce and distribute copies of minutes within three days after each meeting to participants in the meeting and to parties affected by decisions made at the meeting. Furnish three copies of the minutes to the Engineer.
- C. The contractor shall have the following individuals attend meetings, at a minimum:
1. Resident Engineer and Construction Manager.
 2. Contractor Superintendent.
 3. Contractor's Quality Control Manager.
 4. Contractor's Health and Safety Officer.
 5. Subcontractors as appropriate to the agenda.
 6. Suppliers as appropriate to the agenda.
 7. Others.
- D. The Contractor shall administer the following agenda, at a minimum:
1. Review and approval of minutes of previous meeting.
 2. Review of work progress since previous meeting.
 3. Field observations, problems, conflicts.
 4. Problems which impeded construction schedule.
 5. Review of off-site delivery schedules.
 6. Corrective measures and procedures to regain projected schedule.
 7. Revisions to construction schedule.
 8. Progress during succeeding work period.
 9. Coordination of schedules.
 10. Review submittal schedules; expedite as required.
 11. Maintenance of quality and safety standards.

12. Pending changes and substitutions.
13. Review proposed changes for: effect on construction schedule and on completion date.
14. Other Business.

- END OF SECTION -

SECTION 01105

PERMITS

PART 1 GENERAL

1.01 DESCRIPTION

- A. The State has compiled a list of certain permits believed to be required for this project. Other permits may also be required to comply with applicable laws and regulations and shall be obtained by Contractor. The permit list, the purpose of the permit, and the status which includes the entity responsible for obtaining the permit, are contained in a table attached hereafter to this Section. The table represents permit status as of August 26, 1991.
- B. Where Contractor is responsible for obtaining the permits, he shall also be responsible for any permit fees associated therewith.

LIST OF PERMITS

<u>Permit</u>	<u>Status</u>	<u>Division/Agency</u>	<u>Bureau/Authority</u>	<u>Name and Number of Agency Contact</u>
1. Soil Erosion and Sediment Control Plan Certification	Future Application by Contractor.	Morris County SCD	--	Joseph Dunn (201) 285-2953
2. Air Quality Permit				
a. Direct Flame Landfill Gas Flare	Permit filed on behalf of State. Permit pending.	Division of Environmental Quality	Bureau of Air Pollution Control	Iclal Atay (609) 292-6716
b. Landfill Gas Condensate Tank T-102	Permit filed on behalf of State. Permit pending.	Division of Environmental Quality	Bureau of Air Pollution Control	Iclal Atay (609) 292-6716
3. Disruption of Solid Waste Permit	Approved permit equivalent 8/27/90	Division of Solid Waste	Bureau of Landfill Engineering	Sukhdev Bhalla (609) 530-8899
4. Water Allocation Permit	Approved permit equivalent #2409E approved 4/12/91	Division of Water Resources	Bureau of Water Allocation	Helve Saarela (609) 292-2957
5. Ground Water Dewatering Permit	Not required (per 2/21/91) letter from Bureau of Water Allocation)	Division of Water Resources	Bureau of Water Allocation	Helve Saarela (609) 292-2957
6. Stream Encroachment Permit				
a. Landfill Road Crossing	Not required	Division of Coastal Resources	Permit Support Group	John Huryk (609) 984-0799
b. Private Property Replacement Culverts	Future Application by Contractor.	Division of Coastal Resources	Permit Support Group	John Huryk (609) 984-0799

<u>Permit</u>	<u>Status</u>	<u>Division/Agency</u>	<u>Bureau/Authority</u>	<u>Name and Number of Agency Contact</u>
7. Freshwater Wetlands Permit (replaced with Statewide General Permit No. 4)	Permit filed on behalf of State. Permit pending.	Division of Coastal Resources	Bureau of Freshwater Wetlands	John Kale (609) 633-9277
8. NJPDES Discharge to Surficial Water Permit.	Permit filed on behalf of State. Permit pending.	Division of Water Resources	--	--
9. Building Permit				
a. State of New Jersey - DCA	Application required by Contractor	Department of Community Affairs	--	(609) 530-8866
b. Chester Township	Application required by Contractor	Chester Township Construction Official	--	Bob Seanar (908) 879-5584
10. Treatment Works Approval				
a. 8/14/91 comment letter from NJDEP	Permit filed on behalf of State. Permit pending.	Division of Water Resources	--	Raj Shah (609) 292-4860
11. Septic Tank Permit				
a. State	Not required for system capacity less than 2,000 gpd	Division of Water Resources	Bureau of Municipal Discharge Permits	Karen Lane (609) 633-3869
b. Chester Township	Application required by Contractor	Chester Township Engineer	--	(908) 879-5571

<u>Permit</u>	<u>Status</u>	<u>Division/Agency</u>	<u>Bureau/Authority</u>	<u>Name and Number of Agency Contact</u>
12. Road Opening Permit	Application required by Contractor	Chester Township Engineer	--	(908) 879-5571

PART 2 PRODUCTS

A. Not Used.

PART 3 EXECUTION

A. Not Used.

- END OF SECTION -

SECTION 01110

SAFETY, HEALTH, AND EMERGENCY RESPONSE

PART 1 GENERAL

1.01 APPLICABLE PUBLICATIONS, CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

- A. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities: NIOSH, 85-115.
- B. Final Remedial Investigation Report: Remedial Investigation/Feasibility Study, Combe Fill South Landfill, Vol. 1, Lawler, Matusky & Skelly Engineers, May 1986.
- C. Combe Fill South Landfill Superfund Site Remedial Design - Final Design Report. O'Brien & Gere Engineers, Inc., April, 1991.
- D. OSHA Safety and Health Standards: 29 CFR 1910 and 1926.
- E. USEPA Standard Operating Safety Guides: November 1984.
- F. ACGIH Threshold Limit Values and Biological Exposure Indices for 1990-1991.
- G. 49 CFR Parts 171-179.
- H. 49 CFR Parts 390-397.

1.02 SUBMITTALS

- A. Organizational Chart and Resumes submitted by Contractor.
- B. Health and Safety Risk Analysis performed by Contractor.
- C. Hazardous Materials Safety and Health Training Program Summary submitted by Contractor in the HASP.
- D. Program Certification.
- E. Medical Surveillance Program.
- F. Air Monitoring Program.
- G. Daily Log.
- H. Site Standard Operating Procedures (SOP) incorporated into site HASP.

- I. Emergency Response Plan.
- J. Site Specific Health and Safety Plan.

PART 2 PRODUCTS

2.01 GENERAL

- A. This section describes the minimum safety, and health and emergency response requirements for remedial activities at the Combe Fill South Landfill Superfund Site. Requirements of the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, and the other publications listed in Paragraph 1: APPLICABLE PUBLICATIONS of this Section provide the basic safety program for this project. The responsibility of development, implementation, and enforcement of the Health and Safety Plan (HASP) lies with the Contractor and his health and safety personnel. The HASP developed by the Contractor shall include programs for accident prevention, personnel protection, emergency response/contingency planning, and air monitoring.

PART 3 HEALTH AND SAFETY PLAN MINIMUM REQUIREMENTS

3.01 ORGANIZATIONAL RESPONSIBILITIES

- A. Key Personnel and Organizational Chart. The lines of authority, responsibility and communication shall be defined in the HASP. The Contractor must provide at a minimum, an organization chart and resumes of key personnel involved in all phases of the Combe Fill South (CFS) Remedial construction. This chart must include Senior-Level Management, Project Manager, Health and Safety Officer, Field Supervisor, and Foreman Personnel.
- B. Site Health and Safety Officer (HSO). The Contractor must employ a qualified individual (e.g. an industrial hygienist, safety engineer, etc.) to function as the Site Health and Safety Officer (HSO) for the project. That individual must be responsible to the Contractor and have the authority and knowledge necessary to implement the site Health and Safety Plan (HASP) and verify compliance with applicable safety and health requirements.
 - 1. At a minimum, the HSO shall have the following responsibilities and authority to perform the following functions:
 - a. Be present at all times during site operations.
 - b. Have the authority to enforce the HASP and stop operations if personnel safety and health may be jeopardized.
 - c. Effect evacuation of the site if necessary.

- d. Evaluate monitoring data to make field decisions regarding safety and health.
2. The HSO shall meet the following minimum qualifications:
 - a. HSO shall possess a sound working knowledge of State and Federal occupational safety and health regulations and shall have formal educational training in occupational safety and health. Documentation shall be provided that the HSO has completed the 40 hr. OSHA Training Course, the 8 hr. OSHA Supervisor's Training Course and met the field experience requirements.
 - b. Have a minimum of four (4) years experience in the environmental and health and safety services field, chemical industry, or chemical waste disposal industry, more than 50% of which must be in the area of industrial hygiene and/or environmental safety.

3.02 RISK ANALYSIS

- A. Health and Safety Evaluation. The Contractor shall perform and provide a health and safety risk analysis for each location and the operation to be performed.
- B. The risk analysis shall be based upon the best information available regarding the contaminants and conditions present at the site as well as the practices and tools to be applied in the operation and shall include but not be limited to the following:
 1. A preliminary evaluation of the site's characteristics performed prior to site survey.
 2. An evaluation of the known (including the use of chemical safety data sheets) or suspected contaminants and conditions that may pose inhalation, skin absorption/contact or ingestion hazards.
 3. An evaluation of known or potential safety and health hazards associated with each task on the site.
 4. An overview of the following information:
 - a. Size and location of the site.
 - b. Description of the operation and tasks to be performed.
 - c. Approximate duration of the operation and of each task.
 - d. Site topography and special features (e.g. structures, tanks, etc.).

- e. Known or suspected pathways of contaminant dispersion pertinent to the operation and tasks performed.
- f. Site accessibility.

3.03 EMPLOYEE TRAINING

A. Training Requirements for On-Site Personnel

1. All employees engaged in on-site activities which expose or potentially expose them to hazardous substances and/or health hazards must have completed one of the following requirements prior to the start of operations at the site:
 - a. A 40 hour minimum hazardous materials safety and health course, as stipulated in 29 CFR 1910.120 e(3), and a minimum of three days of actual field experience under the direct supervision of a trained experienced supervisor.
 - b. An eight (8) hour minimum refresher course per year after the 40 hour minimum training has occurred (29 CFR 1910.120 e(8)).
2. Workers on site only occasionally for a specific limited task (i.e. ground water monitoring, land surveying or geographical surveying) and who are unlikely to be exposed over permissible and published exposure limits shall have received a minimum of 24 hours of instruction off the site, and a minimum of one day actual field experience with a trained, experienced supervisor.
3. On-site management and supervisors directly responsible for or who supervise employees engaged in site operations, including the on-site health and safety officer, shall have also received eight (8) hours additional training in managing such site operations prior to the start of site activities as stipulated in 29 CFR 1910.120 e(3).
4. Employees who have been designated as responsible for responding to on-site emergencies shall have received additional training in how to respond to such expected emergencies prior to the start of site operations as stipulated in 29 CFR 1910.120 e(7).
5. Employees who have not received the required training prior to the start of site operations are not to engage in site operations until such training has been completed.

B. Employee Training Program

1. The Contractor shall include in the HASP a summary of the hazardous materials safety and health training program and a list of elements and topics covered.

C. Program Certification

1. The Contractor shall provide written certification of completed training and acquired experience for all employees designated to engage in on-site activities. Such certification shall be supplied prior to the start of site operations.
2. Such certification shall be endorsed by a member of top level management, a corporate officer, or the health and safety program manager and shall be incorporated into the HASP for the project.

D. Site Specific Training

1. The Contractor shall provide site specific training and perform daily safety briefings that will provide an awareness of planned operations, the site specific HASP, the form and warning properties of potential hazards, work zones, locations of emergency/safety equipment, local emergency response procedures, site characteristics, levels of protection, communications, decontamination procedures, emergency facilities and signals, and evacuation procedures.

3.04 PERSONNEL PROTECTION

A. Engineering and Work Practice Controls. The Contractor must consider the need to apply engineering and/or work practice controls as a means of protecting personnel in the performance of site specific tasks.

1. When practicable, engineering controls shall be implemented to reduce and maintain employee exposures to or below safe levels for those tasks demonstrating known or suspected hazards.
2. Work practice controls shall next be applied when engineering controls are impracticable and shall be incorporated as site specific standard operating procedures (SOP) for personal precautions and routine operations.

B. Personnel Protective Equipment and Levels of Protection

1. The Contractor shall use personnel protective equipment (PPE) only when engineering and/or work practice controls have been deemed impractical or insufficient to protect employees during site operations.
2. The Contractor shall select PPE based on an evaluation of performance characteristics, site specific tasks, and known or suspected hazards and shall assemble the PPE into levels of protection (LOP) or ensembles appropriate for the site.

3. The Contractor shall include in the HASP a list of components for each protective ensemble, the LOP selected for each task, the rationale for each task-specific selection, and any contaminant action levels to be followed in LOP decision making.

These specific tasks for the Combe Fill South Remedial Design construction shall include:

- Site preparation
 - Construction of erosion and sediment control structures
 - Installation of security fence
 - Site grading/earth moving
 - Handling and disposal of construction water and contaminated water
 - Refuse excavation, and relocation, on site
 - Excavation of drums found on site
 - Installation of Shallow Ground Water Recovery System
 - Construction of on-site ground water treatment plant
 - Installation of cap
 - Installation of gas wells
 - Installation of gas collection system
 - Installation of ground water monitoring wells
 - Ground Water Monitoring
 - Surface water monitoring
4. The Contractor shall include a description of his respiratory protection program and the method of respirator fit testing employed.
5. The Contractor shall use only NIOSH/MSHA approved respiratory protective equipment.
6. The Contractor shall establish a PPE program addressing the following elements:
- a. Site hazards

- b. PPE selection
- c. PPE use
- d. Duration of site operations
- e. PPE maintenance and storage
- f. PPE decontamination
- g. PPE training and proper fit
- h. Donning and doffing procedures
- i. PPE inspection
- j. PPE in-use monitoring
- k. Evaluation of program effectiveness
- l. Heat stress and cold injury prevention

3.05 MEDICAL SURVEILLANCE

- A. Medical Surveillance Program. The Contractor shall establish and implement a medical surveillance program (MSP) for employees engaged in on-site operations, consistent with 29 CFR 1910.120(f).
 - 1. The MSP program shall include physical examinations administered by a board certified physician familiar with internal or occupational medicine. The Contractor shall include the name and business address of the administering physician in the HASP.
 - 2. The Contractor shall include the components of both the MSP program and the physical examination in the HASP.
 - 3. The Contractor shall address the need for personal exposure monitoring and post exposure medical screening in the HASP and include a description of those provisions.
- B. Retention of Medical Records
 - 1. The Contractor shall retain all medical records and personnel exposure monitoring data for an appropriate period as described in Subpart C of 29 CFR 1910.20 of the Occupational Safety and Health Administration.
- C. Personnel Certification
 - 1. The Contractor shall provide written certification of the medical fitness for work of all employees designated to engage in on-site operations prior to the start of those operations.

2. Such certification shall be endorsed by a member of top level management, a corporate officer, or the health and safety program manager and shall be incorporated into the site HASP.

D. Employee Heat and Cold Stress Prevention

1. As dictated by seasonal conditions, the Contractor shall implement an employee heat or cold stress prevention program during site operations and shall incorporate the program into the site HASP.
2. The program shall include employee awareness of the signs and symptoms of heat or cold stress, preventive measures, and environmental and employee parameters to be monitored.
3. The Contractor shall maintain a daily heat or cold stress log on all employees on-site engaging in field activities and shall describe the log in the site HASP.

3.06 AIR SURVEILLANCE

- A. The Contractor shall establish and implement a site specific air monitoring program to identify areas of elevated airborne contaminant concentrations and to determine the level of the concentrations relative to background. The Contractor shall provide the personnel, instruments, and materials necessary to perform such air monitoring and identify the individual responsible for administering the program. The program shall be included in the HASP and presented as a separate section entitled Air Monitoring Plan.

1. The Contractor must incorporate the following information into the air monitoring program:
 - a. Type, make, and model of instrument(s) selected for use.
 - b. All instrument settings for each instrument used.
 - c. Method of instrument calibration, including calibrant and sample calibration data sheet.
 - d. Manner and frequency of field calibration checks.
2. The Contractor must discuss the frequency of air measurements and the tasks or locations to be monitored.
3. The Contractor shall provide instruments for continuous recording of wind direction and velocity to be mounted on a tower with a minimum height of twenty five (25) feet. This tower shall be erected at a suitable location for use during the Construction period and shall be left at the site at the conclusion of construction. The Contractor shall relocate the tower once during the contract period

as directed by the Engineer/Construction Manager at no additional cost to the State.

- B. Area and Personnel Air Sampling. The Contractor shall examine, and report to the Engineer's /NJDEP's satisfaction the need, or lack thereof, to develop and implement an area and personnel air sampling program during the project, based upon adequate initial Area and Personnel Air Sampling episodes, and shall include any resultant air sampling program in the site HASP. The Contractor shall explicitly state the need for an area and sampling program in the HASP.

1. Special considerations shall be given to intrusive or high-risk tasks and the potential for exposure to those performing such tasks. For the Combe Fill South Landfill these high risk tasks include the removal and relocation of refuse on site, drum excavation, and the installation of the water and gas collection wells.
2. The Contractor shall provide all necessary sampling devices, pumps, collection media, and support equipment to perform the sampling per the program. The sampling devices and pumps must be approved for use in combustible or flammable atmospheres.
3. The sampling devices, pumps, collection media, and any necessary support equipment shall be appropriately assembled into a sampling train, and each resultant sampling train shall be flow calibrated as a complete system before and after each day's use against a primary standard.
4. The Contractor shall provide for perimeter air monitoring by establishing a minimum of twelve (12) permanent air monitoring stations around the site perimeter, near the site property lines. The stations need not be equidistant, but should be selected considering homes, workplaces and other possible receptors of emissions. At the start of each work day, the Contractor shall select a minimum of three stations, one upwind of the days work area and two downwind of the days work area. A portable air sampling pump shall be placed at each selected station. A minimum of three (3) sorbent tubes suitable for analysis for volatile organic compound (VOC) shall be collected at each station each day.

At the end of each work week, only the tubes judged by the Engineer to have been collected on the worst day of the week shall be analyzed for VOC. The remaining tubes shall be stored by the Contractor for possible future analyses.

5. If during the course of the work day, air emissions requiring level C or greater protection is required periodic readings shall be taken using a photoionization detector (PID) at the perimeter monitoring stations

established by the Contractor. Readings shall be taken at each station a minimum of once per hour.

6. The Contractor shall maintain a daily sampling record as part of the air sampling program. The record must include, as a minimum, the following:
 - a. Collection data
 - b. Sample identification number
 - c. Location sampled
 - d. Task sampled
 - e. Duration of each sample collected
 - f. Ambient temperature and humidity of sampling period
 - g. Pre- and post- sampling train flow calibration
 - h. Any pertinent comments
7. Any laboratories selected for sample analysis must be NJDEP Certified for specific analytical methods as applicable. The laboratory selected for sample analysis must be accredited by the AIHA for the analysis required. Sampling and analytical methods of NIOSH or OSHA must be used preferentially when such methods are available for the samples collected and all appropriate QA and QC provisions regarding sample collection, transport, and holding times must be followed.

C. Records Retention and Data Reporting

1. The Contractor shall retain all personnel exposure sampling results in accordance with the requirements set forth in OSHA, Subpart C of 29 CFR 1910.20. The Contractor shall follow all other pertinent provisions of that regulation.
2. The Contractor shall submit, in writing, the analytical results from any area and personnel samples collected within 30 working days of the collection of each sample. If applicable, sample flow rates in liters per minute (lpm) and sampling periods in minutes for each sample collected must be reported with the analytical results. Sample locations or tasks and identification numbers shall also be reported.
3. The Contractor shall maintain a daily air monitoring log and include, as a minimum, the following information:
 - a. Monitoring date

- b. Location and/or task monitored
 - c. Wind speed, ambient temperature and humidity
 - d. Instrument used and settings
 - e. Instrument readings
 - f. Pertinent comments or information
 - g. Instrument calibration checks
- 4. The Contractor shall report verbally all data resulting from daily air monitoring to the on-site NJDEP representative, at a minimum, at the end of the work period. If at any time the instrumentation indicates an adverse change in conditions, the HSO must notify the NJDEP representative immediately and follow up this reporting in writing by the close of business on that day.
 - 5. The Contractor shall furnish copies of the daily air monitoring log to the NJDEP representative, at a minimum, weekly, unless otherwise noted or arranged.

3.07 SITE CONTROL

A. Routine Requirements

- 1. For ongoing operations, the Contractor and/or his designee will be required to meet with the on-site NJDEP representative, when present, prior to the start of the day's activities to prepare all the necessary paperwork and outline the day's activities. The Contractor shall also meet at the completion of the day's activities to discuss the work performed.

B. Work Zones

- 1. The Contractor shall be responsible for conducting operations at the site in such a controlled fashion as to reduce the possibility of contact with any contaminants present and to prevent the removal of contaminants by personnel or equipment leaving the site.
- 2. The Contractor shall delineate work zones in which specific operations or tasks will occur and shall institute specific site entry and decontamination procedures at designated control points. Three (3) work zones will be established to perform this work. An exclusion/contamination zone, a contamination/reduction zone and a support/clean zone. A map or diagram showing the work zones and a description of the site control plan shall be included in the HASP.

3. The Contractor shall include any standard operating procedures pertaining to site control in the HASP and shall incorporate plans for routine and emergency communications appropriate for the site and project.
4. The Contractor in accordance with his security plan shall keep a daily visitor log, copies to be provided to the NJDEP/Engineer upon request. A time clock shall be used to record the arrival and departure times. This log shall include:
 - a. Personnel visiting the site
 - b. Affiliation
 - c. Date
 - d. Arrival time
 - e. Departure time
 - f. Purpose of visit
5. No unauthorized personnel shall be permitted to enter the site. The Contractor shall provide the NJDEP representative a list of all Contractor and subcontractor personnel who are authorized to enter the site prior to the start of operations, updating the list as necessary. Predesignated NJDEP personnel shall have unlimited access to the site.
6. The Contractor shall be responsible for conducting operations in accordance with the State's requirements for storage of the Contractor's hazardous materials (i.e. gasoline, lube oils, etc.) on-site, including locating staging areas, labeling/signage, etc.

3.08 DECONTAMINATION

- A. Personnel and Equipment Requirements. All personnel and equipment exiting the Exclusion/Contamination zone must be decontaminated prior to entering the Support/Clean zone. This decontamination must be performed in order to prevent contamination from being transferred into clean areas and contaminating or exposing unprotected personnel. The decontamination requirements for personnel and equipment shall include the requirements listed in the Decontamination Protocol Section, as a minimum.
 1. The Contractor shall develop and implement personnel and equipment decontamination procedures appropriate for the site and include those procedures in the site HASP. The procedures shall include the necessary equipment and personnel and the steps to achieve the objective, provisions for any personnel protection, and a diagram outlining the steps or stations in the procedures.

2. The procedures must ensure adequate containment and removal of any decontamination solutions and spent disposable protective apparel.
 3. Provisions shall be made to facilitate personal hygiene at breaks and following daily operations.
- B. Decontamination procedures shall be monitored by the site safety supervisor to determine their effectiveness.

3.09 SITE STANDARD OPERATING PROCEDURES

- A. The Contractor shall be responsible for developing and implementing all necessary standard operating procedures (SOP) for site operations (i.e. drilling standard operating procedures). Such SOPs shall be incorporated into the site HASP.

3.10 CONTINGENCY PLANNING

- A. Emergency Response Plan. The contractor shall develop and implement an emergency response plan (ERP) to handle anticipated on-site emergencies prior to the start of site operations. The ERP shall be incorporated into the site HASP as a separate section of that document and shall be periodically reviewed and, as necessary, amended to keep it current with new or changing site conditions or information.

1. The ERP shall address, as a minimum, the following:
 - a. Pre-planning of site operations to prevent emergencies
 - b. Personnel roles and lines of authority
 - c. Key person at the site authorized and responsible for implementing the plan
 - d. Emergency recognition and control measures
 - e. Evacuation routes and procedures, frequency of drills
 - f. Safe distances and places of refuge
 - g. Emergency security and site control measures
 - h. Decontamination
 - i. Emergency medical treatment and first aid
 - j. Emergency alerting and response procedures
 - k. Site communications

1. Site diagrams showing general layout, work zones, and prevailing weather conditions
 - m. Procedures for reporting incidents to pertinent local, state, and federal agencies
 - n. A list of emergency telephone contacts including the name, location, telephone number and route to the nearest medical facility that will provide emergency medical services if needed
 - o. Measures to review and follow up on site responses
 - p. Emergency and personal equipment kept at the site for emergencies
2. The Contractor shall attend public meetings or briefings, as necessary, to discuss and present the HASP and ERP. In addition, the Contractor shall address the following requirements:
 - a. Prior to the start of site operations, the Contractor shall attend any and all meetings necessary with local officials and/or those responsible for local emergency management and public safety (to include fire, police, and local health officials) for the purpose of coordinating the site-specific ERP with any emergency response efforts that would be performed by such agencies.
 - b. The Contractor shall contact the local medical facility selected for inclusion into the ERP to ensure that said facility is willing and is capable of providing that medical support necessary to satisfy those anticipated hazards and emergencies detailed in the ERP. Written verification of such contact, including the name of the individual contacted, shall be furnished to the NJDEP representative prior to the start of site operations.
- B. Special Training
1. The Contractor shall ensure that at least one person holding up-to-date certifications (American Red Cross or equivalent) in basic first aid (8 hr minimum) and CPR is present at the site during all site operations.
- C. Accident and Exposure Reports
1. The Contractor shall notify the NJDEP Construction Manager of all on-site accidents at the time of occurrence and follow up in writing within 24 hours. This notification shall include, but not be limited to, the date, time and identity of individual(s) involved in the accident,

witnesses to the accident, the nature of the accident, the actions taken to treat the victim(s), and the steps taken to prevent recurrence.

2. The Contractor shall notify the NJDEP Construction Manager of all person(s) exposed at the time of occurrence and follow up in writing within 24 hours. This notification shall include, but not be limited to, the date, time, and identity of individual(s) involved in the exposure, witnesses to the exposure, the nature of the exposure episode, what the individual(s) were exposed to, the personal protective equipment worn during the exposure, and the steps taken to prevent recurrence.

3.11 CONFINED SPACE OPERATIONS

A. Standard Operating Procedures

1. Should site operations include activities within confined spaces, the Contractor shall develop and implement SOPs in accordance with the NIOSH "Guide to Safety in Confined Spaces", NIOSH publication No. 87-113 (Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402) and shall incorporate them in the HASP.
2. Pre-entry briefings shall be held prior to initiating any confined space entries and at other times as necessary to ensure that employees are aware of the HASP provisions governing such activities and that they are being followed.
3. Inspections shall be conducted by the HSO or, in the absence of that individual, another qualified individual acting on behalf of the Contractor as necessary to determine the effectiveness of the HASP and associated confined space SOPs. Any deficiencies in effectiveness shall be corrected by the Contractor.
4. The Contractor shall ensure that the HSO or, in the absence of that individual, another qualified individual acting on behalf of the Contractor shall test the atmosphere of the confined space prior to entry and that all measures necessary to protect the health and safety of employees entering have been taken.

3.12 DRUM EXCAVATION OPERATIONS

A. Standard Operating Procedures

1. Should site operations include activities requiring the excavation and handling of drums, the Contractor shall develop and implement SOP's in accordance with 29 CFR 1910.120(j) - Hazardous Waste Operations and Emergency Response, Handling Drums and Containers and incorporate them in the HASP.

2. Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the unknown contents of the drums or containers. Assuming worst case preparation scenario, the procedures specified in 29 CFR 1910.120(j)(2) shall be followed in areas where drums or containers are being opened.
3. Inspections shall be conducted by the HSO to determine the effectiveness of the HASP and associated drum handling SOP's. Any deficiencies in effectiveness shall be corrected by the Contractor.

3.13 ROCK BLASTING OPERATION/EXPLOSIVES HANDLING & STORAGE

A. Standard Operating Procedures

1. Should site operations include activities requiring the blasting of rock and the handling and storage of explosives, the Contractor shall develop and implement SOP's in accordance with Subpart U of 29 CFR 1926, Explosives Handling and incorporate them in the HASP.
2. The contractor shall permit only authorized and qualified, as stated in 29 CFR 1926.901, persons to handle and use explosives. Blasting operations above ground shall be conducted between sunup and sundown. The blaster shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in a blast and shall keep an accurate running inventory of all explosives and blasting agents stored on the operation.
3. Due precautions shall be taken by the contractor to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent powerlines, dust storms, or other sources of extraneous electricity. Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators and/or owners have been notified and measures for safe control have been taken.
4. Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited in or near explosive magazines or while explosives are being handled, transported or used. Transportation of explosives shall meet the provisions of Department of Transportation regulations contained in 49 CFR Parts 171-179, Highways and Railways; and 49 CFR Parts 390-397, Motor Carriers.
5. Inspections shall be conducted by the HSO to determine the effectiveness of the HASP and associated explosive

handling SOP's. Any deficiencies in effectiveness shall be corrected by the Contractor.

6. Mapping of proposed blasting locals shall be provided by the Contractor when feasible.

3.14 OPERATIONS WITHIN AND ADJACENT TO THE POWER LINE CORRIDOR

A. Standard Operating Procedures

1. Should site operations include activities requiring the operation of cranes or derricks within or adjacent to the Power Line Corridor, the Contractor shall develop and implement SOP's in accordance with 29 CFR 1926.550(a) - Cranes and Derricks and incorporate them in the HASP.
2. Derrick operations shall be directed only by the individual specifically designated by the Contractor for that purpose.
3. Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the 29 CFR 1926.550(a)(15). The Contractor shall designate a person to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded. Prior to work near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be de-energized or tests shall be made to determine if electrical charge is induced on the crane. The precautions specified in 29 CFR 1926.550(a)(15)(vii) shall be taken when necessary to dissipate induced voltages.
4. Inspections shall be conducted by the HSO or, in absence of that individual, another qualified individual acting on behalf of the Contractor as necessary to determine the effectiveness of the HASP and associated Power Line Corridor SOP's. Any deficiencies in effectiveness shall be corrected by the Contractor.

3.15 FIRE PREVENTION AND PROTECTION

- A. Fire safety equipment must be easily accessible to all on-site personnel and in good operating order. After using any fire equipment, it must be recharged or replaced. All employers must

be trained in the use and location of fire safety equipment. The Contractor shall insure that fire traffic lanes are available (not blocked) and all fire exits are properly marked.

B. Small Fires.

A small fire is defined as a fire that can be extinguished with the available 20 lb. type ABC fire extinguisher. In the event of a small fire at the site, the Contractor and his designated fire control personnel shall take the following minimum actions:

1. Evacuate all unnecessary personnel from the area, if possible to an upwind location;
2. Attempt to extinguish fire using portable fire extinguishers or by smothering;
3. Order the appropriate level of protective clothing to be worn by personnel near the fire;
4. Request emergency response assistance (ambulance, fire, hospital, poison control center) as needed for any injuries or exposures to hazardous chemicals; and
5. Notify the Construction Manager and Region II, USEPA of the incident.

C. Large Fires.

In the event of a large fire or a small fire which cannot be extinguished, the Contractor shall undertake the following minimum actions:

1. Evacuate all unnecessary personnel from the site, preferably to an upwind location;
2. Order the appropriate level of protective clothing to be worn by personnel near the fire;
3. Notify the fire department and other emergency response services (police, ambulance, hospital, poison control center) as needed; and
4. Notify Region II, USEPA and NJDEP of the incident.

3.16 DOCUMENTS SUPPLIED

- A. Site Specific Health and Safety Plan. The site specific HASP shall be furnished as a separate document or as a part of the work plan but shall pertain only to the named site activity. A corporate safety and health manual may be furnished along with

the HASP but this shall not satisfy the site specific HASP requirement.

- END OF SECTION -

SECTION 01120
ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All work shall be performed in a manner which minimizes the pollution of air, water, or land, and shall, within reasonable limits, control noise, the disposal of trash and debris, as well as other pollutants during construction.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100
2. Safety, Health, and Emergency Response: Section 01110
3. Construction Water Management: Section 01125
4. Erosion and Sediment Control: Section 02270

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below, form a part of the specification to the extend referenced. The publication is referred to in the text by basis designation only.

- A. Standards for Soil Erosion and Sediment Control in New Jersey as issued by the State of New Jersey.

1.03 SUBMITTALS

- A. Environmental Pollution Control Plan

PART 2 - PRODUCTS

2.01 POLLUTION CONTROL PROGRAM

- A. Prior to commencement of the work at the site and within 28 calendar days after Notice of Award, the Contractor shall submit his detailed Environmental Pollution Control Plan specified herein.

2.02 PRECONSTRUCTION SURVEY

- A. Prior to start of any on-site construction activities, the Contractor and the Engineer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed

areas either on the Combe Fill South Landfill site or immediately adjacent to the site of the work and adjacent to his assigned storage area and access route(s) as applicable. This report will be signed by both the Engineer and Contractor upon mutual agreement as to its accuracy and completeness.

- B. Prior to the start of any on-site construction activities, the Contractor shall provide a minimum of thirty six (36) 8 in. x 10 in. glossy color photographs showing the entire Combe Fill South Landfill site. The Contractor shall consult with the Construction Manager to determine the views required.
- C. Prior to the start of any on-site construction activities the Contractor shall provide video survey of the entire Combe Fill South Landfill. The video survey shall be provided in VHS format to the State. The Contractor shall consult with the Construction Manager to determine the views required.

PART 3 - EXECUTION

3.01 PROTECTION OF LAND AREAS

- A. Except within the areas of clearing and grubbing or as otherwise approved by the Engineer, the Contractor for any work or storage area and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall be preserved in their present condition. The Contractor shall confine his construction activities to areas defined for work on the Drawings or specifically assigned for his use.

3.02 PROTECTION OF TREES AND SHRUBS

- A. Except within the areas of clearing and grubbing or as otherwise approved by the Engineers, the Contractor shall not damage or destroy trees or shrubs.

3.03 PROTECTION OF WATER RESOURCES

- A. The Contractor shall assure the proper disposal of fuels, oils, bitumens, calcium chloride, acids, or other potentially harmful construction-related materials, both on and off the site premises and shall comply with applicable federal, state, county and municipal laws concerning pollution of rivers and streams while performing work under this contract. Special measures shall be taken to prevent such materials or chemicals from entering public waters. Water used in on-site material processing, concrete curing, and concrete cleanup, and other wastewaters shall not be allowed to reenter a stream.

3.04 DUST CONTROL

- A. The Contractor shall maintain all excavations, embankments, stockpiles, access roads, backfill areas, borrow area, and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others. Approved

temporary methods consisting of sprinkling, approved chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

3.05 EROSION CONTROL

- A. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and backfill areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The areas of bare soil exposed at any one time by construction operations should be held to a minimum. In no case shall any drainage route be adversely impacted by erosion of soil from the construction area. Erosion control shall be conducted in accordance with the certified Erosion and Sedimentation Control Plan developed in accordance with Section 02270.

3.06 HAULING MATERIAL ON STREETS

- A. When it is necessary to haul off-site material over streets or pavements, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dripped from the vehicles, the Contractor shall clean up the same as often as required to keep the streets and pavements clean from dirt, mud, stone or other hauled material. The Contractor is responsible for obtaining all state, county, and town permits or variations to allow transport of any and all materials or equipment on public roadways.

3.07 CORRECTIVE ACTION

- A. The Contractor shall, upon receipt of notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop order shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it was later determined that the Contractor was in compliance. Erosion control shall be conducted in accordance with the certified Erosion and Sediment Control Plan developed in accordance with Section 02270.

3.08 POST-CONSTRUCTION CLEANUP OR OBLITERATION

- A. The Contractor shall, unless otherwise instructed in writing by the Engineer, obliterate all signs of temporary construction

facilities such as work areas, structures, foundations of temporary structures, stockpiles of excess materials, and other vestiges of construction prior to final acceptance of the work.

- END OF SECTION -

SECTION 01125

CONSTRUCTION WATER MANAGEMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Development of an acceptable Construction Water Management Plan detailing the handling, storage, treatment (if necessary), and disposal of all construction water generated during construction.
2. The Contractor is to obtain and operate within all required Local, State, and Federal Permits required to implement the proposed Construction Water Management Plan. A partial listing of required permits is presented in the Special Provisions.
3. Provide all labor, materials, and equipment required for handling, storage, treatment, and disposal of construction water if necessary and contaminated water in accordance with the approved Construction Water Management Plan.
4. Perform all specified and necessary sampling and analyses to insure compliance with required permits and applicable laws and regulations.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100
2. Environmental Protection: Section 01120
3. Spill and Discharge Control: Section 01130
4. Decontamination Protocol: Section 01140

C. Definitions

1. Construction water shall be defined as surface water which has come into contact with refuse, all ground water discharged from excavations in fill/refuse, and water generated from decontamination of equipment and other materials.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not Used

1.03 SUBMITTALS

- A. Construction Water Management Plan

PART 2 PRODUCTS

2.01 MATERIALS

- A. The Contractor shall submit his plan for handling construction water. The plan shall include, but not be limited to the Contractor's proposed method of handling, storage (if necessary), treatment (if necessary), and disposal of construction water generated during construction.
- B. Acceptable methods of handling construction water include, but are not limited to, the following:
 - 1. On-site treatment and discharge
 - 2. Collection, transport, off-site treatment, and disposal
 - 3. Infiltration into the landfill using an absorption field or other appropriate method. Infiltration must be discontinued if it results in a visible discharge to surface water. Infiltration should be discontinued if visible seeps are seen within a 100 ft. radius of the absorption field or other infiltration method.
- C. The Contractor shall submit his plan for handling contaminated water. The plan shall include, but not be limited to the contractor's proposed method of handling, storage, sampling and analyses, and off-site treatment and disposal of contaminated water.

PART 3 EXECUTION

- A. It shall be the responsibility of the Contractor to investigate and comply with all applicable Federal, State, and Local laws and regulations governing the handling, storage governing the disposal of construction and contaminated water. All construction water and contaminated water shall be disposed of in a manner which meets applicable permit requirements, laws, and regulations.
- B. The Contractor shall obtain all required permits, manifests, etc. required for the handling, storage and disposal of construction and contaminated water.
- C. No construction water shall be discharged off-site unless it meets acceptable discharge limits.
- D. If the construction water is to be handled by disposal in the landfill, disposal shall be accomplished in a manner to prevent runoff and the

generation of seeps within a 100 ft. radius of any absorption field.

- E. The contractor shall make every effort to minimize the generation of construction water. Appropriate methods to minimize generation of construction and contaminated water include, but are not limited to erection of temporary berms, use of low permeability tarpaulin or suitable daily cover to cover exposed fill/refuse, limiting the amount of exposed fill/refuse, grading to control run-on and run-off, engineering controls on construction activities to minimize contact of personnel and equipment with refuse/fill thus minimizing the amount of decontamination required, and other appropriate methods.
- F. Water shall be handled utilizing equipment compatible with anticipated contaminants which may be present.

- END OF SECTION -

SECTION 01130
SPILL AND DISCHARGE CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All work required to describe the minimum procedures the Contractor shall follow in the event of spills during site work.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100.
2. Construction Water and Contaminated Water Management: Section 01125.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not Used.

1.03 SUBMITTALS

A. Spill and Discharge Control Plan

B. Spill Incident Reports

PART 2 - PRODUCTS

2.01 SPILL AND DISCHARGE CONTROL PLAN

A. Spill and Discharge Control Plan

1. The Contractor shall develop, implement, maintain, supervise, and be responsible for a Spill and Discharge Control Plan. This plan shall provide contingency measures for potential spills of construction-related materials such as diesel fuel, discharges from dewatering of contaminated water pits or ponds on or surrounding the existing landfill, and discharges of water generated by decontamination.
2. The Contractor shall submit a Spill and Discharge Control Plan within 28 days after receiving Notice of Award. The plan shall contain the following:
 - a. Procedures for Containing Dry and Liquid Spills.
 - b. Absorbent Material available on-site.

- c. Storage of Spilled Materials.
- d. Decontamination Procedures. Decontamination procedures may be required after cleanup to eliminate traces of the substance spilled or reduce it to an acceptable level. Acceptable level shall be determined by the State in consultation with the USEPA. Complete cleanup may require removal of contaminated soils. Personnel decontamination shall include showers and cleansing or disposing of clothing and equipment. All contaminated materials such as soil and wood that cannot be decontaminated must be properly containerized, labeled, and properly disposed of as soon as possible. Any and all testing and disposal costs related to the cleanup of a spill caused by the Contractor's activities shall be borne by the Contractor.
- e. Spill Incident Report. A written report detailing the spill or discharge shall include, at a minimum, the cause and resolution of the incident, outside agencies involved, and date the incident occurred. The report shall be submitted to the State within 24 hours of the incident. The Contractor shall document the location of all spills on the site Drawings and submit the Drawings to the State at project completion.

B. Facilities

- 1. The Contractor shall provide methods, means, and facilities required to prevent contamination of soil, water, atmosphere, equipment, or materials by the discharge of bulk wastes from spills due to Contractor's operations.

C. Equipment

- 1. The Contractor shall provide equipment and personnel to perform emergency measures required to contain any spillage and to remove spilled materials and soils or liquids that become contaminated due to spillage. This collected spill materials shall be properly disposed of at the Contractor's expense.

D. Decontamination

- 1. The Contractor shall provide equipment and personnel to perform decontamination measures that may be required to remove spillage from previously uncontaminated structures, equipment, or material. Decontamination residues shall be properly disposed of at the Contractor's expense.

PART 3 - EXECUTION

3.01 NOTIFICATION

A. The State shall be notified immediately of a spill or discharge. The Contractor shall immediately contact the following agencies:

1. New Jersey Department of Environmental Protection
2. Environmental Protection Agency, Region II
3. Morris County Health Department
4. USEPA Region II Environmental Emergency Response Center

- END OF SECTION -

SECTION 01140
DECONTAMINATION PROTOCOL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All work required for decontamination of personnel and construction equipment.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100
2. Environmental Protection: Section 01120
3. Construction Water Management: Section 01125
4. Safety, Health and Emergency Response: Section 01110

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not Used.

1.03 SUBMITTALS

A. Decontamination Procedure

PART 2 - PRODUCTS

- A. The Contractor shall develop and submit to the Construction Manager/Engineer a decontamination procedure for equipment and personnel. As a minimum, the decontamination procedure shall include items included in Part 3 - Execution.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall dispose of all contaminated and/or uncontaminated liquids included in this section in accordance with the Construction Water Management Plan.
- B. Decontamination methods and equipment shall be chosen so as to minimize decontamination requirements and the possibility of cross contamination.

3.02 PERSONNEL DECONTAMINATION FACILITY

- A. The Contractor shall establish a Contamination Reduction Zone CRZ. Within the Contamination Reduction Zone, a Contamination

Reduction Corridor (CRC) of approximately 75 ft x 15 ft shall be needed for accommodating the required equipment and facilities and for carrying out the personnel decontamination activities. Activities and facilities are listed below:

- Segregated Equipment Drop

Deposit equipment used on the site (e.g., tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.). Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination.

- Suit/Boot/Glove Wash and Rinse

Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water solution. Rinse off decon solution or detergent/water solution using copious amounts of water.

- Air Tank and/or Canister/Mask Changes

If work is conducted under Level C or Level B levels of protection and the worker leaves Exclusion Zone to change air tank and/or canister/mask, this is the last step in the decontamination procedure. Worker's air tank and/or canister/mask is exchanged, new outer glove and boot covers donned, and joints taped. Worker returns to duty.

- Field Wash and Redress

A worker change facility with shower facility, lavatory, lockers and other necessities shall be provided for field wash and redress. The trailer should have enough capacity for crew members to use. All the wash and rinse water related to decontamination should be collected and discharged to the sump for collecting the decon water from equipment and personnel decontamination. The sanitary wastes collected at the dressing trailer shall be removed for off-site disposal by the Contractor at an approved site.

3.03 VEHICLE DECONTAMINATION

- A. All vehicles which have come into contact with exposed refuse/fill shall be steam-cleaned. The area for decontamination of vehicles should be large enough to allow movement of the largest piece of machinery (e.g., dozers, backhoes or front end loaders) and to accommodate a pit, sump and other equipment necessary for carrying out decontamination. The pit should be excavated in an area close to the Exclusion Zone. The surface area of the pit shall be sufficient to accommodate the largest piece of machinery. A sump will be located at one end of the pit to collect the decon water. If necessary, wind screening should be provided for the area around

SECTION 01400
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All work required to prepare and implement a Contractor Quality Control Plan as specified herein.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM)

- | | |
|---------------|---|
| ASTM D698-78 | Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb Rammer and 12 in drop |
| ASTM D1556-82 | Test Method for Density of Soil in Place by the Sand Cone Method |
| ASTM D2922-81 | Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D1557-78 | Modified Proctor Density Test |
| ASTM D75-87 | Sampling Aggregates |
| ASTM D422-63 | Test Method for Particle - Size Analysis of Soils |
| ASTM D2487-85 | Test Method for Classification of Soils for Engineering Purposes |
| ASTM D2167-84 | Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method |
| ASTM D2216-80 | Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures |
| ASTM D4318-84 | Test Method for Liquid Limit; Plastic Limit, and Plasticity Index of Soils |
| ASTM D2434-68 | Test Method for Permeability of Granular Soils (Constant Head) |

ASTM D3740 Practice for Evaluation of Agencies Engaged
in the Testing and/or Inspection of Soil and
Rock Used in Construction.

- B. Office of the Chief of Engineers, Engineer Manuals, U.S. Army Corps of Engineers, EM1110-2-1906, Laboratory Soils Testing, Appendix VII, Permeability with Backpressure Saturation

1.03 SUBMITTALS

- A. Quality Control Plan
- B. Name and Qualifications of Subcontractor operating the On-Site Geotechnical Testing Laboratory
- C. Description of On-Site Laboratory
- D. List of Laboratory apparatus to be used
- E. Quality Control Daily Report

PART 2 PRODUCTS

2.01 QUALITY CONTROL PLAN

- A. General. The Contractor shall furnish for approval by the State, the Contractor Quality Control (CQC) Plan with which he proposes to implement the requirements of Contract. The plan shall identify personnel, procedures, instructions, records and forms to be used. If the Contractor fails to submit an acceptable QC plan within the time herein prescribed, the Construction Manager and Engineer may refuse to allow construction to start until an acceptable interim plan is furnished or withhold funds from progress payments, until such times as the Contractor submits an acceptable final plan. Very limited activity will be permitted on site until the various plans are approved by the State. In scheduling the work a period of at least 2.5 months should be allowed for the initial paperwork.
- B. Coordination Meeting. Before start of construction, the Contractor shall meet with the Construction Manager and Engineer and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and offsite work, and the interrelationship of Contractor's inspection and control with the State's inspection. Minutes of the meeting shall be prepared by the Engineer and signed by both the Contractor and the Construction Manager and Engineer. The minutes shall become a part of the contract file. There may also be occasions when subsequent conferences will be called to reconfirm mutual understandings.

- C. The Quality Control Plan. This plan shall include as a minimum, the following:
1. The description of the quality control organization, including chart showing lines of authority and acknowledgement that the CQC staff shall be in addition to the job supervisory staff and report to the Contractor's management at a level of Vice President or above in the Contractor's organization.
 2. The name, qualifications, duties, responsibilities and authorities of each person assigned a QC function.
 3. A copy of a letter to the QC manager signed by an authorized official of the firm, which describes the responsibilities and delegates the authorities of the QC manager.
 4. Procedures for scheduling and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
 5. Control testing procedures for each specific test. Laboratory facilities will be approved by the Construction Manager and Engineer. Copies of test procedures shall be present on-site and furnished to Construction Manager/Engineer as requested.
 6. Reporting procedures including proposed reporting formats.
- D. Acceptance of Plan. Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The State reserves the right to require the Contractor to make changes in his CQC plan and operations as necessary to obtain the quality specified.
- E. Notification of Changes. After acceptance of the QC plan, the Contractor shall notify the Construction Manager and Engineer in writing of any proposed change. Proposed changes are subject to acceptance by Construction Manager and Engineer.

2.02 QUALITY CONTROL ORGANIZATION

- A. CQC System Manager. The Contractor shall designate a CQC Manager who is independent of the Contractor's Project Manager Superintendent. The CQC System manager for this contract shall be an approved, qualified hazardous materials removal engineer or comparable individual whose sole responsibility is to ensure compliance with contract plans and specifications. This person shall demonstrate his ability to perform correctly the duties required of him to the satisfaction of the Construction Manager and Engineer and shall be physically at the project site whenever work is in progress and will be in charge of the Contractor's Quality Control program for this project. All the

Contractor's submittals for approval shall be reviewed and modified or corrected as needed by him or his authorized assistants and approved correct prior to forwarding of such submittals to the Construction Manager and Engineer.

- B. Personnel. A staff shall be maintained under the direction of the CQC system manager to perform all QC activities. The actual strength of the staff during any specific work period may vary to cover work phase needs, shifts, and rates of placement. The personnel of this staff shall be fully qualified by experience and technical training to perform their assigned responsibilities and shall be directly hired by and work for the prime contractor.
- C. The CQC Organization shall be responsible for certifying that all submittals are in accordance with the contract requirements.

2.03 ON-SITE GEOTECHNICAL TESTING LABORATORY

- A. The Contractor shall develop a section of the CQC Plan detailing the on-site geotechnical laboratory to be established by the Contractor. The Contractor shall provide and coordinate the services of a testing laboratory to perform the analyses described in this subsection. The Contractor shall provide the on-site laboratory facilities with appropriate analytical equipment and qualified personnel to perform geotechnical testing and equipment calibration. All costs, including plant, labor, and materials associated with the installation and operation of the on-site geotechnical laboratory shall be borne by the Contractor.

The geotechnical laboratory shall be operated by an independent Subcontractor. The laboratory shall comply with the requirements specified in ASTM D3740 - Practice for Evaluation Agencies Engaged in the Testing and/or Inspection of Soil and Rock used in Construction. A professional engineer experienced in geotechnical engineering and testing shall be in charge of the laboratory although his continuous presence on-site is not required. Laboratory personnel shall not be employees of the Contractor.

- B. Measuring and testing devices, laboratory equipment, instruments, transportation, labor and supplies necessary to accomplish the required testing shall be provided by the Contractor.
- C. The Contractor shall describe the facilities and equipment of the on-site laboratory.
- D. The Contractor shall submit a list of all laboratory apparatus to be used.
- E. The on-site geotechnical laboratory shall be capable of performing the following test methods in accordance with ASTM or other applicable standards:

ASTM D698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. Rammer and 12-in. Drop
ASTM D1556-82	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2167-84	Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method
ASTM D1557-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb. Rammer and 18-in. Drop
ASTM D75-87	Sampling Aggregates
ASTM D422-63	Test Method for Particle - Size Analysis of Soils
ASTM D2487-85	Test Method for Classification of Soils for Engineering Purposes
ASTM D2216-80	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
ASTM D4318-84	Test Method for Liquid Limit; Plastic Limit, and Plasticity Index of Soils
ASTM D2434-68	Test Method for Permeability of Granular Soils (Constant Head)

Office of the Chief of Engineers, Engineer Manuals, U.S. Army Corps of Engineers, EM1110-2-1906, Laboratory Soils Testing, Appendix VII, Permeability with Backpressure Saturation.

Direct Shear Testing of Interface between Soils and Geosynthetics.

Soil pH.

All other specified tests which can be readily performed in a field laboratory.

PART 3 EXECUTION

3.01 CONTROL

- A. Contractor Quality Control is the means by which the Contractor assures himself that his construction complies with the requirements of the contract plans and specifications. The controls shall be adequate to cover all construction operations, including both on-site and offsite operations, and will be keyed to the proposed construction sequence. The controls shall

include at least three phases of inspection for all definitive features of work as follows:

1. Preparatory Inspection. This shall be performed prior to beginning any work on any definable feature of work. It shall include a review of contract requirements; a check to assure that all materials and/or equipment have been tested, submitted and approved; a check to assure that provisions have been made to provide required control testing; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials, equipment and sample work to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand. The Construction Manager and Engineer shall be notified at least 24 hours in advance of the preparatory inspection and such inspection shall be made a matter of record in the Contractor's Quality Control documentation as required below. Subsequent to the preparatory inspection and prior to commencement of work, the Contractor shall instruct each applicable worker as to the acceptable level of workmanship required in his plan in order to meet contract specifications.
2. Initial Inspection. This shall be performed as soon as a representative portion of the particular feature of work has been accomplished and shall include examination of the quality of workmanship and a review of control testing for compliance with contract requirements, use of defective or damaged materials, omissions, and dimensional requirements. The Construction Manager and Engineer shall be notified at least 24 hours in advance of the initial inspection and such inspection shall be made a matter of record in the CQC documentation as required below.
3. Follow-up Inspections. These shall be performed daily to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. Such inspections shall be made a matter of record in the CQC documentation as required below. Final follow up inspections shall be conducted and test deficiencies corrected prior to the addition of new features of work.

3.02 TESTS

- A. Test Procedure. The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. The Contractor shall procure the services of an industry recognized testing laboratory or he may establish an approved testing laboratory at the project site; this laboratory must be approved by the Construction Manager and Engineer. An on-site geotechnical laboratory must be established at the site. A list of tests (other than chemical sampling and analysis) which the

contractor understands he is to perform shall be furnished as a part of the CQC plan to the Construction Manager and Engineer. The list shall give the test name, specification paragraph containing the test requirements, and the personnel and laboratory responsible for each type of test. The Contractor shall perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms, including all of the test documentation requirements, have been prepared.

B. Testing

1. Capability Check: The Construction Manager/Engineer will have the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques.
2. Capability Re-Check: If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the State for each succeeding re-check of the laboratory or the checking of a subsequently-selected laboratory. Such costs will be deducted from the contract amount due the contractor.
3. Project laboratory: The Construction Manager and Engineer will have the right to the Contractor's control testing laboratory, personnel, and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the State. The Construction Manager and Engineer will have the right to duplicate up to 5% of quality assurance testing utilizing the Contractor's personnel, laboratory, and equipment at no additional cost to the State.
4. Transportation of Samples for Testing: Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the State shall be delivered to an address furnished by the Construction Manager/Engineer.

5. All tests performed by Contractor shall be presented to the Construction Manager/Engineer regardless of whether the test passed or failed.

3.03 COMPLETION INSPECTION

- A. At the completion of all work or any increment thereof established by a completion time stated in the paragraph entitled "Commencement, Prosecution, and Completion of Work" or stated elsewhere in the specifications, the CQC System Manager shall conduct a completion inspection of the work and develop a 'punch list' of items which do not conform to the approved plans and specifications. Such a list shall be included in the CQC documentation, as required by paragraph 3.04 below and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or his staff shall make a second completion inspection to ascertain that all deficiencies have been corrected and so notify the Construction Manager and Engineer. The completion inspection and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.04 DOCUMENTATION

- A. The Contractor shall maintain current records of quality control operations, activities, and tests performed including the work of suppliers and subcontractors. These records shall be on an acceptable form (sample form attached) and indicate a description of trades working on the project, the numbers of personnel working, the weather conditions encountered, any delays encountered, and acknowledgement of deficiencies noted along with the corrective actions taken on current and previous deficiencies. In addition, these records shall include factual evidence that required activities or tests have been performed, including but not limited to the following:
 1. Type and number of control activities and tests involved.
 2. Results of control activities or tests.
 3. Nature of defects, causes for rejection, etc.
 4. Proposed remedial action.
 5. Corrective actions taken.
- B. These records shall cover both conforming and defective or deficient features and shall include a statement that supplies and materials incorporated in the work comply with the contract. Legible copies of these records shall be furnished to the Construction Manager and Engineer daily.

3.05 NOTIFICATION OF NONCOMPLIANCE

- A. The Construction Manager and Engineer will notify the contractor of any noncompliance with the foregoing requirements. The contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the contractor or his representative at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Construction Manager and Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension to time or for excess costs or damages by the Contractor.

- END OF SECTION -

QUALITY CONTROL DAILY REPORT

(CONTRACTOR)

REPORT NO. _____ CONTRACT NO. _____ DATE _____

LOCATION OF WORK (Referenced to Grid Square):

DESCRIPTION: _____

WEATHER _____, RAINFALL _____ INCHES, TEMP: MIN__ MAX__

1. Work Performed Today by Prime Contractor (Include Plant and Labor Breakdown): _____

[illegible]

2. Work Performed Today by Subcontractors (Include Plant and Labor Breakdown): _____

3. List Specific Inspection Performed and Results of these Inspections.
(Include Corrective Actions): _____

4. List Type and Location of Tests Performed and Results of these Tests:

5. Verbal Instructions Received from Construction Manager and Engineer on
Deficiencies or Re-testing Required: _____

6. Remark: _____

7. CERTIFICATION: I certify that the above report is complete and correct and that I, or my authorized representative, have inspected the work performed this day by the prime Contractor and each subcontractor and have determined that all materials, equipment, and workmanship are in strict compliance with the plans and specifications except as may be noted above.

Contractor's Designated Quality Control Manager

SECTION 01510

SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

- A. All labor, materials, and equipment required to provide site security during this Contract.
- B. Related Work Specified Elsewhere
 - 1. Special Project Procedures: Section 01100
 - 2. Safety, Health, and Emergency Response: Section 01110

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. Not Used.

1.03 SUBMITTALS

- A. Security Plan

PART 2 - PRODUCTS

2.01 SECURITY PLAN

- A. Site Security Protocols. The Security Plan shall address as a minimum:
 - Number of Security Personnel;
 - Personnel Duties;
 - Personnel Names and Qualifications;
 - Description of Proposed Daily Security Operations;
 - Description of Security Check Procedures;
 - Descriptions of how the following security breaches shall be handled:
 - Unauthorized personnel on the site (i.e., vandals, trespassers)
 - Site Boundary Security if penetrable (i.e., broken site fence, broken gates)
 - Unauthorized personnel attempting to gain access to the site (i.e., television or newspaper media, public interest groups)

- Description of Standard Operating Procedures for Responses to Emergency Situations (i.e., contingencies, telephone numbers, radio frequencies, and call signs)

PART 3 - EXECUTION

3.01 ENTRANCE CONTROL

- A. Control of all persons and vehicles entering and leaving the project site shall be provided by the Contractor. The Contractor shall exclude from the site personnel not properly identified.
- B. The Contractor shall issue identification to all site workers (including subcontractors) which will include, at a minimum, name, photograph, and employer.
- C. The Contractor shall maintain a current list of accredited persons and subcontractors and submit a copy of the list to the Engineer.
- D. The Contractor shall require display of proper identification by each person and require personnel to sign in upon entering the site and to sign out when leaving.
- E. The Contractor shall maintain a list of all vehicles entering and leaving the site.
- F. No visitors will be allowed on site without the prior approval of the State. Visitors shall not be left unescorted. The Engineer will only escort individuals with the approval of the State Construction Manager.
- G. The Contractor shall maintain a log of visitors which shall include name, affiliation, time, date and purpose of visit.
- H. The Contractor shall require signature of visitors on a form relieving the State, its officers, employees, and agent of the liability of consequences related to potential hazards associated with site entry.
- I. The Contractor shall allow access to the work site only through the main gate off of Parker Road. Site access will be blocked by a guard who operates the gate from within a gatehouse. Guard will only open gate after individuals have been logged in and approved by Contractor. Gatehouse shall have phone and radio contact with Contractor.
- J. A key station will be installed at the guard house for security use with the field trailers.
- K. The guard will report to a key station at gatehouse, field trailers on at least an hourly basis, after working hours.

- L. Activating the key station will be part of the Contractors QA evaluation. Failure to activate the key station will result in non-payment.
- M. The Contractor shall provide copies of the daily personnel visitor, vehicle logs, and guard clock tapes to the Construction Manager and/or Engineer upon request.

3.02 SITE CONTROL

A. General

- 1. The Contractor shall develop and submit his proposed Security Plan, and shall maintain control of the site and shall be responsible for security at the site. The Contractor shall provide 24-hr/day security until construction of the site security fence is completed and accepted. Thereafter, the Contractor shall, as a minimum, provide security during all working hours (construction operation). A security guard will be required on site to log in working personnel at the beginning of each working day and to log out working personnel at the end of each working day.

B. Security Personnel

- 1. The Contractor shall provide sufficient security personnel to accomplish the work outlined in the specifications. The Construction Manager and Engineer shall have the right of approval and rejection of the security personnel assigned to the project site any time during Contractor activities. Security personnel shall be bonded.
- 2. The Contractor shall ensure that all security personnel shall have received the training as specified in Section 01110 - Safety, Health, and Emergency Response.
- 3. The Contractor shall furnish and install the new site security fence and appurtenances around the site as specified and as shown on the Drawings.
- 4. The Contractor shall conduct coordination visits as directed by the Engineer with local law and emergency medical service officials (i.e., local police/sheriff, state police, emergency medical corps units, fire departments, and utility emergency teams) to map out contingency plans for emergency situations.

- END OF SECTION -

SECTION 01520

TEMPORARY UTILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All labor, materials, and equipment to provide all on-site facilities and personnel with temporary utilities including electricity, telephone service, water, and sanitary service.

B. Related Work Specified Elsewhere

1. Special Project Procedures: Section 01100
2. Safety, Health, and Emergency Response: Section 01110
3. Security: Section 01510

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis of designation only.

- A. Safety and Health Requirements Manual USACE EM 385-1-1, October, 1984.
- B. National Electrical Code (Latest Edition).
- C. National Electrical Safety Code (Latest Edition).
- D. Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120.

1.03 SUBMITTALS

- A. Not Used.

PART 2 - PRODUCTS

- A. Not Used.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall:
 - 1. Comply with National Electrical Code, Federal, State, and Local Codes and Regulations, Utility Company Requirements, related sections of the specifications, USACE requirements, and National Electrical Safety Code.
- B. Except where noted otherwise, material may be new or used, but shall be adequate in capacity for the required usage, must not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

3.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. The Contractor shall make all arrangements with the utility company for the service required for power and lighting, and shall pay all costs for installation, service, and for power used and arrange for sufficient transformer capacity. Information regarding electrical service may be obtained from: Jersey Central Power and Light Co., 310 Madison Avenue, Morristown, New Jersey 07960, 201-455-8200.
- B. The Contractor shall be responsible for determining actual power requirements and arranging with the local utility for installation and service of a new transformer with associated wiring and electrical equipment, as necessary to perform site work activities. The Contractor shall be responsible for assuring that the system is sufficient and adequate for all temporary power needs.
- C. All work shall be by personnel familiar with code requirements and qualified for the work to be performed. At a minimum, personnel shall work under the direction of a licensed electrician. The Contractor shall install circuit and branch wiring with area distribution boxes located so that power and lighting are available throughout the construction site by the use of construction-type power cords. Temporary wiring shall be guarded, buried, or isolated by elevation to prevent accidental contact by workers or equipment.
- D. All circuits throughout the construction site shall be protected either by a ground fault interrupter or an approved grounding system.
- E. The Contractor shall provide adequate artificial lighting for all areas of work as designated by the Engineer, when natural light is not adequate for work. Work areas shall be lighted to not less than the minimum illumination intensities listed in Table H-102.1 of OSHA Standard 29 CFR 1910.120.

- F. All electrical work shall be in accordance with the National Electrical Code of latest issue.
- G. The Contractor shall be responsible for disconnecting and removing the temporary electrical and lighting systems at the completion of the contract work.

3.03 TEMPORARY TELEPHONE SERVICE

- A. The Contractor shall arrange with the local telephone service company to provide all the telephone service required at the construction site. The service required shall include:
- B. Three direct line instruments and three lines in the Engineers field office.
- C. Three direct line instruments and three lines in the State field office.
- D. One direct line instrument in the equipment trailer.
- E. Call waiting telephone option shall be included with the telephone service.
- F. Other instruments at the option of the Contractor, or as required by regulations.
- G. The FAX line shall be separate from the telephone line.
- H. The Contractor's requirements for his telephone service shall be left to his discretion.
- I. Contractor shall be responsible for arranging for removal of all telephone service at the completion of the contract work.
- J. The Contractor shall pay all costs of initial installation of telephone service in Engineer's and State's offices. Engineer will pay the monthly bills for service.

3.04 TEMPORARY WATER

- A. Water service to the site currently does not exist. An adequate supply of potable water (bottled drinking water) shall be provided on-site, located in the Field Offices of the Engineer, State, and the Contractor.
- B. The quantity of water required for equipment and personnel decontamination, dust control, and other site activities shall be determined by the Contractor. Non potable water outlets, such as for fire fighting purposes, shall be clearly identified indicating that the water is unsafe and is not to be used for drinking, washing, or cooking purposes. A backup supply shall be considered so as not to impede Contractor's operations.

- C. The Contractor shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the work site, within controlled access work zones, and shall be so equipped as to enable employees to remove hazardous substances.

3.05 TEMPORARY SANITARY FACILITIES

- A. All sanitary facilities shall be of the flush toilet type. The Contractor shall provide the sanitary facilities in compliance with state and local regulations. The Engineer's and the State's trailer shall be provided with a flush toilet and wash facilities that can be integrated inside as a part of the office. All sanitary wastes will drain by gravity to a sump or tank, and pumped into a tank truck at suitable intervals and removed from the site for disposal at a treatment facility.

- END OF SECTION -

SECTION 02000
FIELD OFFICE TRAILER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. This Section includes the furnishing, installation and maintenance of a separate field office trailer, one each for the exclusive use of the Engineer and State.

In addition, this section shall include all operating expenses associated with the field office trailers. The Contractor shall pay for telephone service for both Engineer's and State's office.

2. The field office trailer shall be ready for occupancy within ten (10) days following the notice to proceed and shall be provided and maintained until final acceptance of the work conducted under this contract.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. New Jersey State Laws and Regulations governing trailer construction.

B. Building Occupancy and Code Administrators (BOCA).

1.03 SUBMITTALS

The Contractor shall submit drawings within two weeks following award of Contract to the Engineer for approval, showing the layout, furnishings, and facilities of the field office trailer and information concerning how the Contractor proposes to furnish the required utilities.

PART 2 - PRODUCT

2.01 GENERAL

The office shall be set up, equipped, and made ready for use prior to the beginning of work on the project and shall remain until all field records pertinent to the project have been completed. It shall be maintained in good condition and appearance by the Contractor for the duration of the project and shall then be removed and disposed off-site by him, and the site cleaned up and left in a neat and acceptable

condition. A sample layout of the office is shown on the sketch appended to this section.

A. Construction Requirements For the Trailer

1. The floors, walls, and ceiling of the office shall be entirely enclosed, waterproofed, sealed, and provided with 3 1/2 in. thick, R-11 rated fiberglass insulation in the exterior walls and floor, and R-21 rated fiberglass insulation in the roof.
2. The floor system shall consist of 2 x 6 in. joists at 16 in. O.C. with 5/8 in. plywood decking (16 in. O.C. Span Index), covered with 1/8 in. vinyl tile.
3. The exterior walls shall be made of 2 x 4 in. framing @ 16 in. O.C. with single 2 x 4 in. top and bottom plates. The interior wall height shall be 8 ft - 0 in. The interior walls shall be covered with 1/4 in. prefinished paneling. The sheathing shall be 1/8 in. thermo ply and siding shall be prefinished aluminum 0.019 in. thick in white or beige color.
4. The interior walls shall be made of 2 x 4 in. framing @ 16 in. O.C. with single 2 x 4 in. top and bottom plates covered with 1/4 in. prefinished paneling. The ceiling shall be finished with 3/8 in. white prefinished gypsum panels (Class A Flame Spread Rating). All interior trim shall be prefinished.
5. One standard closet shall be built in, 24 x 30 in. full height from floor to ceiling, and shall be equipped with door and lock and 3 shelves.
6. The roof shall be truss type, overhead duct type at 16 in. O.C. (30 lb live, BOCA). The sheathing shall be 3/8 in. plywood (16/0 Span Index) covered with 30 gauge galvanized steel.
7. The two (2) exterior doors shall be 36 x 80 in. steel, foam core, wood framed, with 10 x 10 in. clear safety sight glass, keyed lock, and closer. The interior doors shall be prefinished hollow core. An additional hasp shall be hung on each door of the Construction Manager/Engineer trailers.
8. There shall be three (3) 46 x 27 in., eight (8) 30 x 27 in., and one (1) 24 x 14 in. exterior windows. All twelve windows shall be single glazed, mill finished aluminum, horizontal slides with insect screens and factory built and installed security screens and Venetian blinds.
9. The electrical service shall be 120/240 V single phase, 4 wire 60 Hz. with a 200 amp. main breaker and service box with sufficient breakers and space for spares. There

shall be eight (8) 4 foot twin tube surface mounted fluorescent light fixtures, ten (10) 125 volt 20 amp duplex grounding type receptacles and four (4) 120 volt toggle type switches.

10. The bathroom shall be furnished as a standard trailer 1/2 bath, i.e., with a sink and mirror, toilet with water closet, and 10 gallon electric hot water heater. An 8 in. ceiling power exhaust fan, by NoTone, Model No. 4C210, or equal, shall also be furnished.
11. The HVAC system shall be sufficient to provide 70 degrees F. at zero degrees outside temperature and ninety degrees F. outside temperature. For heating there shall be (1) 15kw, 230 volt resistance heat strip and for cooling (1) 36,000 BTU volt "Bard" end mounted, exterior mounted. The ducts shall be sized appropriately to reach the eight (8) 10 in. diameter ceiling diffusers (white with adjustable damper).
12. The trailer shall be leveled on concrete blocks, and steps with handrails with a platform or landing shall be provided at each exterior door.
13. Aluminum covered plywood skirts, the same color as the trailer, shall be placed around the entire perimeter of the trailer between the bottom frame and the ground surface.
14. A built in standard plan table with double door cabinet underneath shall be furnished, located as shown on the sketch appended at the end of this section.

The trailer shall comply in all respects with all the latest New Jersey State laws and regulations regarding trailer construction, including BOCA code and New Jersey State seal specifications.

The appended sketch indicates the required layout of the trailer. Each of the smaller rooms shall be provided with standard backcounters, four standard undercounter file cabinets, and overhead shelves.

The trailer shall be Model No. 1264 as manufactured by Commercial Structures Corp., and furnished by Redi Space, East Port Street, Port Newark, NJ, or equal. Service points for electrical and sewer connections will be provided by the Contractor from on-site locations. All hook ups and installation of all services to those service points must be furnished and installed by the Contractor.

The office sanitary toilet in the respective trailers shall be for the exclusive use of the Engineer and his staff, and for the State/EPA staff, and such facilities shall meet the requirements of authorities having jurisdiction. Satisfactory janitorial

services for each trailer shall be provided by the Contractor at no additional cost to the State, and shall include daily mopping, sweeping, waste removal, and weekly wet cleanup and cleaning of windows, and the provision paper towels and toilet paper.

B. Furnishings

Each trailer shall be furnished with new equipment as noted herein, and as listed in the tabulation which follows:

1. As manufactured by Hon Co., Wilson Ave., Newark, NJ., or equal. Two (2) desks with locks, 60 x 30 in., Black, Metro Classic Series, Model No. 33050. One (1) 60 x 30 in. desk with lock, Black, Style No. 32975L with accompanying Style No. 32975R 40 x 18 in. return desk, Black. Three (3) high back swivel chairs with arms, upholstered with gray cloth, Style No. C27. Four (4) book cases 41 in. H x 34 in. W x 12 5/8 in. D, Style No. S42ABC. Four (4) Fireshield style fireproof, 4-drawer legal size filing cabinets with lock, Style No. 94CP. One (1) steno chair, gray, Style No. Z 36. Four (4) side chairs, gray, Style No. C 46.
2. Three (3) waste paper baskets 15 1/2 x 11 1/4 x 20 in. as manufactured by Rubbermaid, or equal.
3. One (1) drafting table stool as manufactured by Plan Hold, or equal.
4. Two (2) dry chemical fire extinguishers, UL listed 1A-10BC as manufactured by Walter Kiddie & Co., Inc., Bellville, NJ, Model No. 2 5/8 TPS-2, or equal and two (2) non-residue fire extinguishers with a minimum size of 10B:C.
5. One (1) electric bottled water cooler as furnished by the Great Bear Water Co., or equal, with hot and cold water spigots. Water shall be furnished by the Contractor as needed from Great Bear, or equal.
6. One (1) copying machine as manufactured by Xerox Corp., Model No. 1025, or equal. The Contractor shall maintain the machine for the duration of the contract through a service agreement with Xerox and shall provide all ancillary supplies. Two cases of 8 1/2 x 11 will be provided at initial occupancy.
7. One (1) telefax machine with separate phone line. Machine shall be a plain paper fax machine, Savin Savinfax 630, or equal. The Contractor shall maintain the machine for the duration of the contract through a service agreement with an appropriate agency and shall provide all ancillary supplies. One carton of photocopy quality paper suitable for use with the machine shall be delivered to the site initially. Thereafter the supply of copier paper shall be

furnished by the contractor as needed at no additional cost to the State.

8. One (1) personal computer shall be supplied with a printer and software as shown below.

The Engineer's trailer shall be furnished with the following.

- a. Personal Computer shall be an IBM, Compac or CompuADD model with the following features:

- 80286 processor operating at least 16 MHz clock speed
- 640 Kilobytes of memory (RAM)
- One 40 Megabyte internal hard disk drive
- One 5 1/4" 360 Kilobyte floppy disk drive
- One 3 1/2" 1.44 Megabyte / 720 Kilobyte floppy disk drive
- One serial port
- One parallel port
- One Battery backed real time clock
- One 101-key enhanced keyboard
- One 12" VGA Color Monitor
- One Hayes 2400 Baud Modem

- b. Personal Computer Printer shall be a Hewlett-Packard LaserJet III with the following features:

- 8 Pages per minute print speed
- 1 Megabyte of memory (RAM)
- HP PCL5 & GL2 compatible
- 14 resident fonts (rotatable)
- 8 resident scalable fonts (rotatable)
- Parallel interface
- 10' Parallel printer cable (Centronics)
- HP Wordperfect font cartridge

- c. One copy of each of the following Personal Computer software packages shall be supplied:

- Disk Operating System (DOS) Version 3.3
- WordPerfect Version 5.1 Word processing software with HP LaserJet III printer configuration file.
- Dataease International Dataease version 4.2
- Timeline by Symantec
- LOTUS 123
- Procomm by DATASTAR

The State's Trailer shall be furnished with the following:

- a. Personal Computer shall be an IBM, Compac or CompuADD model with the following features:

- 80286 processor operating at least 16 MHz clock speed
 - 640 Kilobytes of memory (RAM)
 - One 40 megabyte internal hard disk drive
 - One 5 1/4" 360 kilobyte floppy disk drive
 - One 3 1/2" 1.44 megabyte /720 kilobyte floppy disk drive
 - One serial port
 - One parallel port
 - One battery backed real time clock
 - One 101-key enhanced keyboard
 - One 12" VGA Color Monitor
 - 2400 Baud Modem, Hayes compatible
- b. Personal Computer shall be equal to a Hewlett-Packard Laserjet IIP
- c. One copy of each of the following Personal Computer software packages shall be supplied:
- Disk Operating System (DOS) Version 3.3
 - Word Perfect Version 5.1 Word Processing software with HP LaserJet IIP printer configuration file
 - Quattro - Pro spreadsheet
 - Q & A word processor and database
 - Quickschedule
 - QModem or equal communications
 - Project management software compatible with that used by the Contractor.
9. One (1) twelve unit rolling vertical plan stand with document extension. Unit shall be designed to accommodate 12 sets of 30 x 40 plans. Unit shall be as manufactured by Plan Hold, Model 27RS, or equal.
10. One (1) folding type utility table, 30 inches high and having top dimensions of not less than 30 x 60 in.
11. One (1) camera, 35 mm single lens reflex, Canon AE-1, or equal, with wide angle to telephoto zoom lens, complete with camera case and flash attachments. Twenty rolls of 24 exposure 200 as a print film, Kodak, or equal, and twenty rolls of 24 exposure 200 as a slide film, Kodak, or equal shall be furnished initially. Thereafter the supply of film shall be furnished by the Contractor on an as needed basis at no additional cost to the State.
12. One (1) Polaroid camera, Model Sun 660, autofocus SE, or equal, with flash attachments. Twenty packets of film shall be furnished initially. Thereafter the supply of film shall be furnished by the Contractor at no additional cost to the Owner.

13. One (1) VHS video camera and color monitor, Model Panasonic AG-190U, or equal. Features include close-ups with the 8X Power Zoom Lens, Piezo Auto Focus, Macro Auto Focus, 270,000-Pixel, CCD Image Sensor, High-Speed Electronic Shutter (1/1,000 second and 1/500 second), Rotary Erase Head, Automatic-Tracing, White Balance, 0.9 inch Electronic Viewfinder (EVF) with on-screen display, Fade-in/Fade-out (Audio and Video). Twenty tapes of film shall be furnished initially. Thereafter the supply of tapes shall be furnished by the Contractor at no additional cost to the Owner.
14. Two (2) 12 place thermal printing calculator with display and memory, grand total register, item count key and alpha-numeric printing. Unit shall be as manufactured by Texas Instruments, Model K9-TI-5225, or equal. Printing paper shall be provided by the Contractor for the duration of the contract.
15. One (1) 4.3 Cu. Ft. refrigerator, Model GR-49 by Gerald Industries, Inc., or equal.
16. One (1) first aid kit, Model #150 by Zee Medical Service, Hawthorne, NY, or equal.
17. One (1) Selectric Three, Model No. 6704 electric typewriter as manufactured by IBM, or equal.
18. Two (2) steel lockers, 15 x 18 x 78 in. overall, including 6 in. legs with flat key locks and two keys, Model 5062 by Lyon Metal Products, Inc., Union, NJ, or equal.
19. One (1) microwave oven, General Electric Spacemaker III, or equal.
20. Four (4) two line (minimum) pushbutton telephones. One desk type in each room and an additional wall type with an extra long cord in the large room.
21. One (1) telephone answering machine with remote access capabilities.
22. Vehicles and Insurance as specified by the State.

C. All the new equipment provided by the Contractor listed under items #1 (only the four (4) fireproof filing cabinets), #7, #8, #9, #11, #12, and #13 in the "Furnishings" list above shall remain the property of the State. New equipment included in these items are the four (4) fireproof filing cabinets, telefax machine, computer/printer, plan stand, cameras (35 mm, Polaroid, VHS Video). The remaining equipment items not included in these specified item numbers will remain the property of the Contractor.

- D. Each field office trailer shall be furnished with three (3) individual direct line telephone service for the exclusive use of the Engineer and the State. The Contractor is responsible for providing and maintaining telephone services to the field office trailer until such a time the field office trailer is removed from the Contract Work Area.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The field office trailer shall be installed at a location directed by the Engineer.
- B. Maintenance of the trailer shall include, adequate heating and cooling, electrical power and lighting, sanitary facilities, snow removal as required, and biweekly janitorial services. Prior to the completion of the placement of the soil barrier layer, all garbage, dust, and miscellaneous material collected during clean-up of these facilities shall be placed within the limits of the site at a location approved by the Engineer or disposed of as deemed acceptable by the Engineer. All wastewater from the toilet facilities shall be collected, stored, and disposed of at a location approved by the Engineer. The Contractor shall be part of any township recycling effort.

Following completion of the soil barrier layer, all garbage, dust, and miscellaneous material collected during clean-up of these facilities shall be disposed of off-site at no additional cost to the State.

- C. Prior to on-site construction, the Contractor shall submit a description of his scheme for disposing of trash and debris resulting from the work under this Contract. Prior to the completion of site regrading, trash and debris shall be buried within the landfill and covered with suitable embankment material. Upon completion of site regrading, the Contractor shall provide for off-site disposal of trash and debris generated by this project at no additional cost to the State.

- END OF SECTION -

SECTION 02001

PROJECT SIGN

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included

1. The furnishing, installation and maintenance of project identification signs.
2. The project sign shall be painted with black letters and emblems for the State of New Jersey (State Seal), NJDEP, and the EPA as shown on the Drawings and as specified herein.
3. The project sign shall be erected within twenty-eight (28) days following the notice to proceed and shall be maintained until acceptance of the Contract.
4. On acceptance of the Contract, the Contractor shall remove the sign and they shall become his property.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not Used

1.03 SUBMITTALS

- A. Paint and primer specifications and colors.
- B. Sketch of sign location, height above grade, orientation and depth of posts.

PART 2 - PRODUCTS

2.01 GENERAL

1. The Contractor shall obtain the proper wording for the sign from the Engineer.
2. All lumber and plywood shall be structural quality and exterior grade (pressure treated).
3. All bolts, nuts, and washers shall be first quality plated or galvanized steel or equal as approved by the Engineer.

B. Painting

1. All paint shall be oil based, high quality, fade and weather resistant, formulated for exterior sign applications and compatible with exterior grade plywood and primer. All paint, color type, and primer specs shall be submitted to the Engineer for approval.
2. The sign face backgrounds shall consist of a minimum of two (2) coats of white paint.
3. All lettering shall be black in color.
4. The backs of the signs and all supports, bracing and trim, shall be painted with a minimum of two (2) coats of the same white paint used for the sign face backgrounds.

PART 3 - EXECUTION

3.01 GENERAL

1. Prior to site mobilization the Contractor shall submit a sketch detailing proposed sign location, height above grade, orientation, and depth of posts for approval by the Engineer.
2. After the sign location is approved and prior to excavation for the post holes. The Contractor shall verify with all appropriate utility authorities that no interferences exist and satisfactory clearances will be met.
3. The project sign shall be constructed, painted, and installed as detailed on this drawing within 28 working days following the notice to proceed and shall be maintained until acceptance of the Contract.
4. The signs shall be adequately supported and braced and properly positioned and aligned.

B. Maintenance

1. The Contractor shall provide any and all patching, painting, lettering, bracing, and other repairs required to maintain the signs in good condition throughout the duration of the Contract.

C. Closure

1. The sign is to remain on site until contract completion, and upon notification from the Engineer dismantled and disposed of in a location as approved by the Engineer.

- END OF SECTION -

SECTION 02110

CLEARING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included

1. Site clearing by removal, destruction, and disposal of trees, underbrush, logs, stumps, brush, rubbish, decayed or growing matter above the surface of the ground, and snow or ice in areas to be cleared and grubbed.
2. Grubbing including the removal and disposal of stumps and roots from areas to be grubbed.
3. Disposal of surface debris encountered at the site including but not limited to cars, drums, old fences, etc.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Embankment: Section 02222
3. Trenching, Backfilling and Compacting: Section 02226

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not Used.

1.03 SUBMITTALS

A. Not Used.

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

A. Contractor shall protect trees with suitable stakes.

PART 3 - EXECUTION

3.01 GENERAL

A. Clearing

1. Trees, underbrush, logs, stumps, brush, rubbish, and decayed or growing matter above the surface of the ground shall be cleared and cut off flush with or below the ground surface.

2. Surface debris encountered at the site including, but not limited to, cars, drums, old fences, etc. shall be removed and disposed of within the limits of the landfill under the cap as directed by the Engineer.

B. Grubbing

1. Any stumps and roots over 1/2 inch in diameter shall be removed to at least 18 inches below the surface. Any depressions, potholes, ruts, etc. in the surfaces to be covered shall be filled with embankment material and compacted to final grade.

C. Disposal

1. All trees, brush, logs, stumps, and vegetative matter shall be chipped and spread throughout the landfill prior to placing the initial fill.
2. Debris shall not be burned. All brush, trees, stumps, debris, refuse, and spoil material shall be removed from the area and disposed of by the Contractor in the landfill.
3. Surface debris encountered at the site including, but not limited to, cars, drums, old fences, etc. shall be removed and disposed of within the limits of the landfill under the cap per the plans or as directed by the Engineer.
4. Tires encountered during fill/refuse relocation are to be collected and shall be buried a minimum of six feet deep within the limits of capping, as directed by the Engineer.

- END OF SECTION -

SECTION 02220

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation and backfilling including the loosening, removing, refilling, transporting, storage and disposal of all materials classified as "earth" necessary to be removed for the construction and completion of all work under the Contract.
2. Excavation to the widths and depths shown on the Contract Drawings, specified or directed.

B. Related Work Specified Elsewhere

1. Safety, Health and Emergency Response: Section 01110
2. Rock Removal: Section 02228
3. Structural Excavation, Backfill and Compaction: Section 02224
4. Test Pit Excavation and Backfilling: Section 02221
5. Fill/Refuse Relocation: Section 02229
6. Trenching, Backfilling and Compacting: Section 02226
7. Select Fill: Section 02230
8. Restoration of Surfaces: Section 02502
9. Topsoil and Seeding: Section 02980

C. Definitions

1. Excavation (or Trenching)

- Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for all purposes of the construction and completion of all the work under Construction;
- All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removal of the same;
- All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, wellpointing or otherwise controlling water;
- The removing and disposing of all surplus materials from the excavations in the manner specified;
- The maintenance, accommodation and protection of travel and the temporary paving of highways, roads and driveways;
- The supporting and protection of all tracks, rails, buildings, curbs, sidewalks, pavements, overhead

wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury;

- All temporary bridging and fencing and the removing of same.

2. Earth

- All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, and roots or pieces of timber, soft or disintegrated rock, ledge or bedrock and individual boulders or masonry.

3. Backfill

- The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

4. Spoil

- Surplus excavated materials not required or not suitable for backfills or embankments.

5. Embankments

- Fills constructed above the original surface of the ground or such other elevation as specified or directed.

6. Limiting Subgrade

- The bottom of the pipe embedment for pipelines.
- The underside of footing lines or mudmats for structures.

7. Excavation Below Subgrade

- Excavation below the limiting subgrades of structures or pipelines.
- Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required
- The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as

directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM D1556-82 Test Method for Density of Soil in Place by the Sand-Cone Method

ASTM D2167-84 Test method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D1557-78,
Method D Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop.

ASTM D2922-81 Test methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

B. Occupational Safety and Health Act (OSHA)

1.03 SUBMITTALS

A. Shop Drawings

1. Contractor shall submit design, including drawings and design notes, of all sheeting and bracing to the Engineer at least two weeks prior to excavation where sheeting and bracing shall be used in accordance with the provisions set forth in The General Requirements.

2. Design of sheeting and bracing shall be signed and sealed by a registered Professional Engineer licensed to do work in the State of New Jersey.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.01 UNAUTHORIZED EXCAVATION

A. Description

1. Whenever excavations are carried beyond or below the lines and grades shown on the Contract Drawings, or as given or directed by the Engineer, all such excavated space shall be refilled with Lining, Special Backfill, concrete or other materials as the Engineer may direct. All refilling of unauthorized excavations shall be at the Contractor's expense.
2. All material which slides, falls or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense and no extra compensation will be paid the Contractor for any materials ordered for refilling the void areas left by the slide, fall or cave-in.

3.02 REMOVAL OF WATER

A. General

1. The Contractor shall at all times during construction, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the execution of the work or the proper placing of pipes, structures or other work.
2. Unless otherwise specified, all excavations which extend down to or below the static ground water elevations shall be dewatered by lowering and maintaining the ground water beneath such excavations at all times when work thereon is in progress during subgrade preparation and the placing of the structure or pipe thereon.
3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.
4. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a wellpoint system to prevent the upward flow of water during construction.

5. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of in an appropriate manner without injury to adjacent property, the work under construction, or to pavements, roads, drives, and water courses. No water from dewatering operations shall be discharged to sanitary sewers or combined sewers. Sanitary sewage shall be pumped to sanitary sewers or combined sewers, or trucked to a publicly owned treatment works (POTW).
6. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.

B. Work Included

1. Construction and removal of cofferdams, sheeting and bracing, and the furnishing of materials and labor necessary therefor.
2. Excavation and maintenance of ditches and sluice ways.
3. Furnishing and operation of pumps, wellpoints, and appurtenances needed to maintain thorough drainage of the work in a satisfactory manner.

C. Wellpoint Systems

1. Installation

- a. The wellpoint system shall be designed and installed by or under the supervision of an organization whose principal business is wellpointing and which has at least five consecutive years of similar experience and can furnish a representative list of satisfactory similar operations.
- b. Wellpoint headers, points and other pertinent equipment shall not be placed within the limits of the excavation in such a manner or location as to interfere with the laying of pipe or trenching operations or with the excavation and construction of other structures.
- c. Detached observation wells of similar construction to the wellpoints shall be installed at intervals of not less than 50 feet along the opposite side of the excavation from the header pipe and line of wellpoints, to a depth of at least five feet below the proposed excavation. In addition, one wellpoint in every 50 feet shall be fitted with a tee, plug and valve so that the wellpoint can be converted for use as an observation well. Observation wells shall be not less than 1-1/2" in diameter.
- d. Standby gasoline or diesel powered equipment shall be provided so that in the event of failure of the

operating equipment, the standby equipment can be readily connected to the system. The standby equipment shall be maintained in good order and actuated regularly not less than twice a week.

2. Operation

- a. Where wellpoints are used, the groundwater shall be lowered and maintained continuously (day and night) at a level not less than two feet below the bottom of the excavation. Excavation will not be permitted at a level lower than two feet above the water level as indicated by the observation wells.
- b. The effluent pumped from the wellpoints shall be examined periodically by qualified personnel to determine if the system is operating satisfactorily without the removal of fines.
- c. The water level shall not be permitted to rise until construction in the immediate area is completed and the excavation backfilled.

3.03 STORAGE OF MATERIALS

A. Topsoil

1. Topsoil from outside limits of fill/refuse suitable for final grading outside limits of fill/refuse shall be removed and stored separately from other excavated material. Payment for billable excavation volumes in these areas will be based on final topography.

B. Excavated Materials

1. All excavated materials shall be stored in locations and in a manner approved by the Engineer so as not to endanger the work, and so that easy access may be had at all times to all parts of the excavation. Stored materials shall be kept neatly piled and trimmed, so as to cause as little inconvenience as possible to public travel or to adjoining property holders.
2. Special precautions must be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways and other points where access may involve the safety and welfare of the general public.

3.04 DISPOSAL OF MATERIALS

A. Spoil Material

1. All spoil shall be transported to and placed in approved spoil areas.

2. The surface of all spoil areas shall be graded and dressed and no unsightly mounds or heaps shall be left on completion of the work.

3.05 SHEETING AND BRACING

A. Installation

1. The Contractor shall furnish, place, and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, injure the pipe, structures or other work; diminish the width necessary for construction; otherwise damage or delay the work of the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.
2. In no case will bracing be permitted against pipes or structures in trenches or other excavations.
3. Sheeting shall be driven as the excavation progresses, and in such manner as to maintain pressure against the original ground at all times. The sheeting shall be driven vertically with the edges tight together, and all bracing shall be of such design and strength as to maintain the sheeting in its proper position.
4. The Contractor shall be solely responsible for the adequacy of all sheeting and bracing to meet all construction, health and safety and other applicable requirements.

B. Removal

1. In general, all sheeting and bracing, whether of steel, wood or other material used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a pipe or structural foundation shall not be withdrawn, unless otherwise directed, before more than six inches of earth is placed above the top of the pipe or structural foundation and before any bracing is removed. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.
2. The Contractor shall not remove sheeting and bracing until the work has attained the necessary strength to permit placing of backfill.

C. Left in Place

1. If, to serve any purpose of his own, the Contractor files a written request for permission to leave sheeting or

bracing in the trench or excavation, the Engineer may grant such permission in writing. The cost of such sheeting and bracing be assumed and paid by the Contractor.

2. In case sheeting is left in place, it shall be cut off or driven down as directed so that no portion shall remain within 12 inches of the finished street or ground surface.

3.06 BACKFILLING

A. General

1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown, specified or directed.
2. Backfilling shall be done with suitable excavated materials which can be satisfactorily compacted during refilling of the excavation. In the event the excavated materials are not suitable, Special Backfill as specified or ordered by the Engineer shall be used for backfilling.
3. Any settlement occurring in the backfilled excavations shall be refilled and compacted.

B. Unsuitable Materials

1. Stones, pieces of rock or pieces of pavement greater than one cubic foot in volume or greater than 1.5 feet in any single dimension shall not be used in any portion of the backfill without prior approval or direction by the Engineer.
2. All stones, pieces of rock or pavement shall be distributed through the backfill and alternated with earth backfill in such a manner that all interstices between them shall be filled with earth.
3. Frozen earth shall not be used for backfilling.

C. Compaction and Density Control

1. The compaction shall be as specified for the type of earthwork, i.e., structural, trenching or embankment.
 - a. The compaction shall be to the percent of maximum dry density specified.
 - b. The compaction equipment shall be suitable for the material encountered.
2. Where required, to assure adequate compaction, in-place density test shall be made by an approved testing laboratory.

- a. The moisture-density relationship of the backfill material shall be determined by ASTM 1557, Method D.
 - 1) Compaction curves for the full range of materials used shall be developed.
 - b. In-place density shall be determined by the methods of ASTM D1556 or ASTM D2922 and shall be expressed as a percentage of maximum dry density. In place density shall be tested at a minimum frequency of 1 test per 10,000 SF with an representative areal distribution, or as directed by the Engineer. At a minimum 10% of the in-place density test shall be performed using ASTM D1556 adjacent to tests performed in ASTM 2922. The Contractor shall provide a written explanation of the differences in the results of the two test methods.
3. Where required, to obtain the optimum moisture content, the Contractor shall add, at his own expense, sufficient water during compaction to assure the specified maximum density of the backfill. If, due to rain or other causes, the material exceeds the optimum moisture content, it shall be allowed to dry before resuming compaction or filling efforts.
 4. The Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of backfill.

3.07 OTHER REQUIREMENTS

A. Drainage

1. All material deposited in roadway ditches or other water courses shall be removed immediately after backfilling is completed and the section grades and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

B. Unfinished Work

1. When, for any reason, the work is left unfinished, all trenches and excavations shall be filled and all roadways, sidewalks and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways and sidewalks shall have a temporary pavement.

C. Hauling Material on Streets

1. When it is necessary to haul material over the streets or pavements, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or

pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled material.

D. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of his operations to such a degree that it will not endanger the safety and welfare of site personnel and the general public as outlined in the health and safety plan.
2. Dust control requirements at the site shall meet the OSHA requirements listed in 29 CFR 1910.1000.

E. Test Pits

1. For the purpose of obtaining detail locations of underground obstructions, the Contractor shall make excavations in advance of the work. No additional payment will be made for this work.

- END OF SECTION -

SECTION 02222

EMBANKMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Work specified within this section describes the foundation for the cap.
2. Earth embankments shall be constructed to established lines and grades at the locations shown on the Contract Drawings and as directed by the Engineer.
3. Embankment material shall be free from frost, stumps, trees, roots, sods, muck, marl, vegetable matter or other unsuitable material and shall be suitable for compaction as described in the following provisions.
4. Embankment material will be free of hazardous materials in accordance with the Special Provisions.

The Contractor should exercise reasonable necessary care to avoid using contaminated materials. Routine analyses is not required but the State reserves the right to test suspect materials at the State's expense and reject them if the material exceeds the limits. The rejected materials shall be removed from the site even if they have been incorporated into the work.

5. Embankments outside the final limits of the cap shall be constructed to such elevations as to make allowance for any settlement that may occur. Prior to the construction of any structure, roadway or other ground feature and before final acceptance of the Contract, the Contractor shall regrade the embankments to conform to the established lines and grades.
6. Base of clay subgrade to be constructed to account for settlement unless otherwise directed by Engineer.
7. Whenever possible, as directed by the Engineer, on-site material shall be utilized prior to material from off-site sources.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Rock Removal: Section 02222
3. Test Pit Excavation and Backfilling: Section 02226
4. Topsoil and Seeding: Section 02980

1.02 TESTING

- A. All soil testing services necessary for the Contractor to obtain an approved embankment material including field and laboratory services required during the approval process and during installation of the embankment material shall be provided by the Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specifications to the extent referenced. The publications are referred to in the text by basis designation only.

- A. American Society of Testing and Materials (ASTM).

ASTM D422-63	Method for Particle Size Analysis of Soils
ASTM D1556-82	Test Method for Density of Soil In Place by the Sand-Cone Method
ASTM D2922-81	Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
ASTM D2167-84	Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method
ASTM D1557-78, Method D	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-in. Drop.

1.04 SUBMITTALS

- A. In the event that additional embankment material is required, information on the source of this material and the results of any testing used to locate this material shall be submitted to the Engineer for approval. As a minimum, this information shall include a topographic map showing the location of the borrow source, the extent of excavation required to obtain the required quantities of materials, the location within the borrow source from which samples were collected for any laboratory testing, and the results of any laboratory testing performed to characterize soils from the borrow source. A copy of required mining permits must also be submitted to completely document the proposed borrow source.
- B. Source material must be tested to determine the appropriate range of moisture density relationships.
- C. Location of samples collected within borrow areas for laboratory testing.
- D. Proposed soil testing laboratory.

- E. Laboratory testing methods to be used.
- F. Results of laboratory testing.
- G. Required surface disturbance permits.

1.05 QUALITY ASSURANCE

- A. During the placement of embankment materials the following quality assurance tests will be required:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Grain Size	ASTM D422-63	One per 5,000 cy or when material changes are noted	N/A
Soil Moisture Density Relationship	ASTM D1557-78	Once per 5,000 cy or when material changes are noted	N/A

*N.A. - Not Applicable

- B. Field quality assurance shall include visual field inspection by the Engineer to insure that the embankment material meets the following requirements:

- Embankment material will be free of frost, stumps, trees, roots, sods, muck, marl, vegetable matter or other unsuitable material;
- Stones will not exceed 6 inches in greatest dimension unless otherwise approved by the Engineer. Stones will be well distributed throughout the soil mass. Stone is defined as rock material either in its natural or broken state.

- C. Following installation of embankment, the Contractor shall conduct the following quality assurance tests:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
In-place density	ASTM D1556-82 or ASTM D2922-81 or ASTM D2167-84	One per 10,000 SF or when material changes are noted	Minimum of 95% maximum dry density as determined by ASTM D1557-78 Method D utilizing curves developed under 1.05 A above or as otherwise specified

Testing performed using ASTM D2922-81 shall be duplicated at a rate of 10% utilizing either ASTM D1556-82 or ASTM D2167-84

adjacent to the testing performed by ASTM D2922-81. The Contractor shall provide an explanation between the differences in duplicate testing.

- D. In the event that a portion of the embankment fails the quality assurance criteria, the Contractor shall re-compact the embankment to the areal limits defined by other tests meeting the criteria, and retested. In the event of subsequent failure the entire area failing the second test shall be removed and replaced.
- E. The Contractor shall provide at least 2 days notice prior to sampling borrow source. The Contractor shall provide transportation for the Construction Manager and Engineer to and from the borrow source in order that the Construction Manager and Engineer may witness borrow source sampling.

PART 2 - PRODUCTS

2.01 EMBANKMENT MATERIAL

- A. Embankment material shall be obtained from a source approved by the Engineer.
- B. Stones shall not exceed 6 inches in greatest dimension and shall be well distributed throughout the soil mass. Stone shall be defined as rock material either in its natural or broken state.
- C. Stones not well mixed with soil material shall not be used in earth embankments unless the stone material is sufficiently deteriorated or friable so as to be compactible to achieve minimum voids and required density.
- D. Embankment material shall be friable and free from roots, organic matter, or other deleterious materials. Embankment material shall be clayey gravel or clayey sand meeting the following gradation requirements:

<u>Sieve #</u>	<u>% Passing</u>
1 inch	100
3/8 inch	70-100
No. 20	30-80
No. 200	5-35

- E. The Contractor shall submit to the Engineer grain size analyses (up to 10) on soil samples collected from the proposed borrow area at locations selected by the Engineer.
- F. If at any time during the contract for good reason the engineer requests further soils testing to insure that the characteristics of the embankment material obtained from the borrow area(s) have not changed, the Contractor shall perform these tests at no cost to the owner.

PART 3 - EXECUTION

3.01 PLACEMENT AND COMPACTION

- A. Surfaces to be covered with embankment shall be grubbed and stripped of all grass, vegetation, topsoil, or other unsuitable material before any embankment material is placed.
- B. Embankment materials shall be placed in lifts not greater than 12-inches of thickness unless greater thickness is allowed by the Engineer upon demonstration by the Contractor that the material and compaction efforts are adequate to obtain the required density.
- C. Material shall be placed in a uniform lift and thoroughly compacted by equipment suitable for the material encountered to obtain the required density prior to the placement of succeeding lifts. Each lift shall be tested for proper compaction before successive lifts are applied.
- D. In the event that a portion of the embankment fails the quality assurance criteria, the Contractor shall re-compact the embankment to the areal limits defined by other tests meeting the criteria, and retested. In the event of subsequent failure the entire area failing the second test shall be removed and replaced.
- E. Where required, the Contractor shall, at his own expense, add sufficient water during the compaction effort to assure proper density. If, due to the rain or other causes, the material exceeds the optimum moisture content for satisfactory compaction, it shall be allowed to dry, assisted by discing or harrowing, if necessary, before compaction or filling effort is resumed.
- F. All embankment areas shall be compacted to 95% of the maximum density achieved during the modified proctor density test (ASTM D-1557-78, Method D), or as otherwise specified in the Contract Drawings or Specifications.
 - 1. Compaction curves for full range of soil materials to be used in the embankment shall be developed.

- END OF SECTION -

SECTION 02224

STRUCTURAL EXCAVATION, BACKFILL & COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation and backfill as required for the construction of structures in accordance with the applicable provisions of the Section entitled "Earthwork" unless modified herein.

B. Related Work Specified Elsewhere:

1. Earthwork: Section 02220
2. Rock Removal: Section 02228
3. Trenching, Backfilling and Compacting: Section 02226
4. Select Fill: Section 02230
5. Restoration of Surfaces: Section 02502
6. Topsoil and Seeding: Section 02980

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM).

ASTM D1557-78 Method D	Test Methods for Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop.
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1.03 SUBMITTALS

A. Compaction Test Results.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.01 GENERAL

A. Limits of Excavation

1. Excavations shall be made to the elevations or subgrades specified and shall be only of sufficient size to allow suitable room for the proper construction of structures

and appurtenances, including allowances for sheeting, dewatering and other similar work necessary for completion of the Contract.

2. Normal subgrade for structures shall be the underside of footing lines or mud mats, if installed.
3. In no case will undercutting excavation faces be permitted.

B. Subsurface Reinforcement

1. Where an unstable subgrade is encountered and subject to the prior approval of the Engineer, Select Fill may be used for subgrade reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers, each layer being entirely embedded in the subsoil by thorough tamping.
2. All excess material shall be removed to compensate for the displacement by the Select Fill and the finished elevation shall not be above the specified subgrade.
3. Where subgrade reinforcement is unsatisfactory, 2500 psi minimum 28 day strength concrete mud mat of sufficient thickness to withstand subsequent construction operations shall be installed below the specified elevation and the structure concrete deposited thereon.

C. Subsurface

1. Subsurface for all concrete structures shall be undisturbed original earth or, mud mat on undisturbed original earth, or where excavation below subgrade is ordered, it shall be thoroughly compacted Special Backfill or 2500 psi minimum 28 day strength concrete as specified or directed and shall be sufficiently stable to remain firm and intact during the preparation for the placing of concrete thereon.

D. Removal of Water

1. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work.
2. The removal of water shall be in accordance with the Section entitled "Earthwork".

E. Backfilling

1. Backfilling shall be with suitable excavated materials

which can be compacted as specified. In the event the excavated materials are not suitable, Special Backfill as specified or ordered by the Engineer shall be used for backfilling.

2. Backfilling around structures shall not be commenced before the structure has developed sufficient strength to withstand the loads applied. No backfill material shall be allowed to fall directly on a structure, until at least 12 inches of material has been hand placed and compacted nor shall any material be pushed directly against a structure in backfilling.
3. Backfill around structures shall be deposited in horizontal layers and at no greater than 6" thickness without prior approval of Engineer thickness than can be compacted to obtain the specified minimum densities.

F. Compaction

1. Where roadways, driveways, sidewalks, foundations or other features are to be constructed on the backfilled area, the entire backfill shall be compacted to obtain 95% of maximum dry density. Other areas shall be compacted to obtain 90% of maximum dry density.
2. The moisture density relationship shall be determined by ASTM 1557-78, Method D and the procedure for sampling, testing and developing the compaction curves shall be as specified under the Section entitled "Earthwork".

- END OF SECTION -

SECTION 02226

TRENCHING, BACKFILLING & COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation and backfill as required for pipe installation or other construction in the trench in accordance with the applicable provisions of the Section entitled "Earthwork" unless modified herein.
2. The removal and disposal of water.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Structural Excavation, Backfill and Compaction: Section 02224
3. Select Fill: Section 02230
4. Restoration of Surfaces: Section 02502
5. Pipeline Installation: Section 02600
6. Topsoil and Seeding: Section 02980
7. The section pertaining to the type of pipe being installed.

C. Definitions

1. Lining (Pipe Embedment)

Any type granular materials specified or directed placed below an imaginary line drawn one foot above the top of pipe barrel and within the excavation limits.

2. Special Backfill

a. Pipelines

Any selected material specified or directed placed above an imaginary line drawn one foot above the top of pipe barrel and within the excavation limits.

b. Structures

Any selected material specified or directed to be placed within the excavation limits, either in, under or adjacent to the structure.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM)

ASTM D1557-78

Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop.

1.03 SUBMITTALS

A. Results of Testing of Backfill Material

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. The trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath ground surface or surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.
- B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.
- C. The Contractor shall be responsible for maintaining alignment and depth by some suitable method.
- D. Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.
- E. Bridging across trenches shall be constructed and maintained where required, including but not limited to driveways, streets, walkways and other traveled areas.

3.02 SUBGRADE PREPARATION FOR PIPE

- A. Where pipe is to be laid on Lining, the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with Lining as specified or directed, and shall be deposited in layers not to exceed 6 inches and shall be compacted prior to the preparation of pipe subgrade per the specification of the subgrade material and retested with a minimal frequency of once every 100 ft. along the length of the pipe.
- B. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

3.03 STORAGE OF MATERIALS

- A. Traffic shall be maintained at all times in accordance with the applicable Highway Permits. Where no Highway Permit is required at least one-half of the street must be kept open for traffic.
- B. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The excess material shall be removed to on-site locations selected by the Contractor with the approval of the Engineer/Construction Manager.
- C. When the pipe is complete, the Contractor shall, at his own cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.
- D. If directed by the Engineer, the Contractor shall refill trenches with Select Fill or other suitable materials and excess excavated materials shall be disposed of as spoil.

3.04 REMOVAL OF WATER AND DRAINAGE

- A. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work.
- B. The removal of water shall be in accordance with the Section entitled "Earthwork".

3.05 PIPE EMBEDMENT

- A. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly² compacted on each side, and back of the bell of each pipe as laid.
- B. Pipe embedment materials placed at any point below the centerline of the pipe shall be deposited and compacted in layers not to exceed 6-inches in uncompacted depth and such deposition and compaction shall be done simultaneously and uniformly on both sides of the pipe. All such materials shall be placed in the trench in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses.
- C. Concrete cradle and encasement of the class specified shall be installed where and as shown on the Contract Drawings or directed by the Engineer. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle or encasement shall extend the full width of the trench as excavated unless otherwise authorized by the Engineer. Where concrete is to be placed in a sheeted trench, it shall be poured directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.
- D. Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12 inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of pipe being installed. No rocks or boulders shall be in contact with the pipe.

3.06 BACKFILL ABOVE EMBEDMENT

- A. The remaining portion of the pipe trenches above the embedment shall be refilled with suitable materials compacted as specified. Where trenches are within the ditch-to-ditch limits of any street or road or within a driveway or sidewalk, the trench shall be refilled in horizontal layers not more than 8 inches in thickness and compacted to obtain 95% maximum density as determined in accordance with ASTM D1557-78.
- B. Where trenches are in open fields or unimproved areas outside of the ditch limits of roads the backfilling may be by placing the material in the trench and mounding the surface.
- C. Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.

- D. Backfilling of trenches beneath, across or adjacent to drainage ditches and water courses shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches and the backfill shall be protected from surface erosion by adequate means.
- E. All settlement of the backfill within the pipe trench shall be refilled and compacted as it occurs.

- END OF SECTION -

SECTION 02228

ROCK REMOVAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Rock removal to the widths and depths shown on the Contract Drawings or as directed by the Engineer, including the loosening, removing, transporting, storing and disposal of all materials requiring blasting, barring, or wedging for removal from their original beds.
2. Backfill of rock excavations with acceptable materials.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Structural Excavation, Backfill and Compaction: Section 02224
3. Trenching, Backfilling and Compacting: Section 02226
4. Select Fill: Section 02230
5. Embankment: Section 02222
6. Restoration of Surfaces: Section 02502

C. Definitions

1. Rock
 - a. All pieces of ledge or bedrock, boulders or masonry larger than one-half cubic yard in volume.
 - b. Any material requiring blasting, barring, or wedging for removal from its original bed.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. Explosives shall be stored, handled and used in conformity with all applicable laws and regulations.
- B. All appropriate local authorities (fire, police, etc.) shall be notified in advance of all planned blasting work efforts.

1.03 SUBMITTALS

- A. Before any blasting operations begin the Contractor shall obtain all permits and licenses required.

PART 2 - PRODUCTS

2.01 BLASTING

A. General

1. Handling of explosives and blasting shall be done only by licensed/certified experienced persons. Registered as appropriate to all Federal, State and Local Requirements concerning insured requirements.
2. Handling and blasting shall be in accordance with all Federal, State and local laws, rules and regulations relating to the possession, handling, storage and transportation and use of explosives.
3. All blasts in open cut shall be properly covered and protected with approved blasting mats.
4. Charges shall be of such size that the excavation will not be unduly large and shall be so arranged and timed that adjacent rock, upon or against which pipelines or structures are to be built, will not be shattered.
5. Blasting will not be permitted within 25 feet of pipelines or structures.
6. All existing pipes or structures exposed during excavation shall be adequately protected from damage before proceeding with the blasting.

B. Repair of Damages Due to Blasting

1. Any injury or damage to the work or to existing pipes or structures shall be repaired or rebuilt by the Contractor at his expense.
2. Whenever blasting may damage adjacent rock, pipes or structures, blasting shall be discontinued and the rock removed by drilling, barring, wedging or other methods.

C. Explosives

1. At no time shall an excessive amount of explosives be kept at the site of the work. Such explosives shall be stored, handled and used in conformity with all applicable laws and regulations.
2. Accurate daily records shall be kept showing the amounts of explosives on hand, both at the site and at any storage magazine, the quantities received and issued, and the purpose for which issued.

3. The Contractor shall be responsible for any damage or injury to any persons, property or structures as a result of his handling, storage or use of explosives.

PART 3 - EXECUTION

3.01 ROCK CLEARANCE IN TRENCHES

- A. Ledge rock, boulders and large stones shall be removed from the sides and bottom of the trench to provide clearance for the specified embedment of each pipe section, joint or appurtenance; but in no instance shall the clearance be less than 6-inches. Additional clearance at the pipe bell or joint shall be provided to allow for the proper make-up of the joint.
- B. At the transition from an earth bottom to a rock bottom the minimum bottom clearance shall be 12-inches for a distance of not less than five (5) feet.

3.02 ROCK CLEARANCE AT STRUCTURES

- A. Concrete for structures shall be placed directly on the rock and the excavation shall be only to the elevations and grades shown on the Contract Drawings.

3.03 EXCAVATION AND BACKFILL

- A. Rock removal and backfilling shall be performed in accordance with the applicable provisions of the Section entitled "Earthwork".
- B. The rock excavated which cannot be incorporated into the backfill material, as specified, shall be disposed of as spoil and shall be replaced with the quantity of acceptable material required for backfilling.

- END OF SECTION -

SECTION 02229
FILL/REFUSE RELOCATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation and backfilling including the loosening, removing, refilling of all materials classified as fill/refuse to be removed for the construction and completion of all work under the Contract.
2. Excavation to the widths and depths shown on the Contract Drawings, specified, or directed.

B. Related Work Specified Elsewhere

1. Earthwork - Section 02200
2. Test Pit Excavation and Backfilling: Section 02229
3. Embankment - Section 02222

C. Definitions

1. Fill/Refuse shall be defined as any non-native materials located at the site, including but not limited to household waste, industrial waste, construction demolition, debris and associated cover soil.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Not used.

1.03 SUBMITTALS

A. Method of Fill/Refuse Compaction.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.01 FILL/REFUSE EXCAVATION

- A. Excavation of fill/refuse shall be performed as specified on the Contract Drawings. All fill/refuse excavated shall be placed within the limits of the landfill in a location which will minimize rehandling in order to meet the final grades. The Contractor shall be aware that final grades shown on the plans may change following a resurvey of the site as described in the Special Provisions.

- B. The Contractor shall not expose fill/refuse deposits in excess of the quantity which can be excavated and placed in one working day. The Contractor shall operate only one excavation in any area of the site by excavating to final fill/refuse zone grades in one working day unless otherwise authorized by the Engineer.
- C. At the end of each working day, the Contractor shall apply a layer temporary cover, prior to achieving final grade at base of cap consisting of embankment soil not less than 6 inches in thickness over all exposed fill/refuse, including that placed during the days and the area exposed by excavation. Other methods of providing temporary cover, such as foam or tarpaulin may be employed if approved by the Engineer.
- D. Embankment soil used as temporary cover under Subsection 2.01C of this specification may be used for temporary cover as the work progresses provided it is segregated from fill/refuse prior to the re-initiation of excavation. At the completion of the work, all embankment material used as temporary cover shall be placed within the limits of the capped area. All soil excavated with the fill/refuse, shall be within the landfill limits to be capped. The cost associated with reuse of embankment material utilized by the Contractor as temporary cover shall be at no additional cost to the State.
- E. The Contractor shall excavate fill/refuse by means of appropriate procedures and equipment. Normal earthwork excavation shall be used wherever possible.
- F. The Contractor shall avoid excessive disturbance of the excavated fill/refuse, to control release of odors and methane, and to minimize abrasion which could produce sparking. In general, transport of fill/refuse using scraper type earth moving equipment or trucks will be preferred. Excavation and movement by bulldozers or similar equipment will be permitted over only small distances to minimize the above noted hazards. In the event the Engineer determines that the Contractor is employing inappropriate procedures or equipment, the Engineer shall issue a written order establishing the limits of acceptable procedures and noting acceptable equipment.
- G. The Contractor shall excavate to undisturbed subgrade materials where excavation of fill/refuse located outside the limits of the landfill is required. The Contractor shall transport, place, and compact the fill/refuse within the limits of the landfill.
- I. In areas outside the limits of the main waste fill, the depth of fill/refuse to be excavated is not known. The Contractor shall perform such excavations only as directed by the Engineer/Construction Manager to the level of undisturbed subgrade or as otherwise directed by the Construction Manager and/or Engineer in a practicable manner, and shall place embankment material over any fill/refuse remaining exposed at the end of the working day. Such excavations performed without

the approval of the Construction Manager/Engineer will require to backfill the excavation as directed by the Construction Manager/Engineer. The Contractor shall limit the area of fill/refuse exposed at any time wherever feasible. The uncertainty concerning the depth of the fill/refuse deposits may require placement of several layers of embankment material when the complete excavation cannot be accomplished in one working day.

3.02 COMPACTION

- A. The Contractor shall place and compact fill/refuse material as necessary to achieve required subgrades under the final cap. Prior to any fill/refuse excavation activities, the contractor shall submit his proposed method of fill/refuse compaction to the Engineer for approval. Compaction may be accomplished by the following methods, subject to approval by the Engineer upon completion of on-site field tests by the Contractor.

1. Pneumatic - Tired Compactors:

A lift thickness of 18 inches shall be used, the minimum pneumatic compactor class shall consist of Class F with a tire size of 13.00 X 24, number plys is 18, inflation pressure (psi) of 100* and the range of ballasted wheel loads (lbs. per wheel) allowed on that lift thickness shall be 8,000-10,000. A maximum loose lift thickness (in) shall consist of 18 inches. The minimum effort for all pneumatic compactors shall be 6 passes, at speeds up to 12 feet per second (fps) on no more than the first 2 passes, and all subsequent passes at speeds of 6 fps or less.

(*Inflation pressure for not less than the last two passes on each lift. May be reduced during earlier passes and gradually increased to this level.)

2. Vibratory Drum Compactors:

This type of compactor is defined as a machine which primarily develops its compactive effort from the vibrations created and is classified for use according to the developed compactive force rating per linear inch of drum width (PLI). A lift thickness of 18 inches shall be used. The minimum effective compactive force, PLI, used shall be 740 and the minimum effort on such a lift shall be 6 passes at 4.5 fps.

3. Sheepsfoot Rollers:

A lift thickness of 18 inches shall be used. The minimum stress level shall consist of a tire psi of 40. The minimum effort for all sheepsfoot rollers shall be 6 passes, operating at speeds not exceeding 6 feet per second when towed and 15 feet per second when self-

propelled. Compaction shall continue until the sheepsfoot roller can "walk out" of the compacted material.

4. Other Type of Compactor:

Compactor types other than those classified above (i.e. landfill compactors), may be employed by the Contractor, subject to approval by the Engineer of the proposed minimum applied effort (minimum number of passes and travel speed) and maximum lift thickness. Such approval by the Engineer will be based upon the results of appropriate on-site field tests.

- B. The Engineer/Construction Manager be availed the equipment adequate compaction in a given area defined by location on a daily basis. If the Engineer/Construction Manager is not provided this opportunity by the Contractor, area compacted on that day are subject to rejection.

- END OF SECTION -

SECTION 02230

SELECT FILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

Selected fill materials shall be used as either Lining or Special Backfill as specified or as directed by the Engineer.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Embankment: Section 02222
3. Rock Removal: Section 02228
4. Structural Excavation, Backfilling and Compaction: Section 02224
5. Trenching, Backfilling and Compacting: Section 02226
6. Restoration of Surfaces: Section 02502
7. Hand Placed Rip Rap: Section 02272
8. Dumped Rip Rap: Section 02271

C. Definitions

1. Lining (Pipe Embedment)

Any type granular material specified or directed placed below an imaginary line drawn one foot above the top of pipe barrel and within the excavation limits.

2. Special Backfill

a. Pipelines

Any selected material specified or directed placed above an imaginary line drawn one foot above the top of the pipe barrel and within the trench limits.

b. Structures

Any selected material specified or directed to be placed within the excavation limits, either in, under or adjacent to the structure.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below form a part of the specification to the extent referenced. The publication is referred to in the text by basis designation only.

- A. New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction.

1.03 SUBMITTALS

- A. Source material must be tested to determine the appropriate range of moisture-density relationships.
- B. Location of samples collected within borrow areas for laboratory testing.
- C. Proposed soil testing laboratory.
- D. Laboratory testing methods to be used.
- E. Results of laboratory testing.
- F. Required surface disturbance permits.

1.04 QUALITY ASSURANCE

- A. The Contractor shall provide at least 2 days notice prior to sampling borrow source. The Contractor shall provide transportation for the Contraction Manager and Engineer to and from the borrow source in order that the Construction Manager and Engineer may witness borrow source sampling.

PART 2 - PRODUCTS

2.01 SELECT FILL MATERIALS

- A. Type A

- 1. Crushed Gravel

Thoroughly washed screened gravel or clean, sound, tough, hard stone free from coatings meeting requirements for No. 4 Type Coarse Aggregate in Section 901 of the NJDOT specifications. It shall consist of crushed and uncrushed particles and shall have a gradation by weight of the following:

<u>% Passing</u>	<u>Sieve</u>
100	2-inch
90-100	1½-inch
20-55	1-inch
0-15	¾-inch
0-5	⅜-inch

B. Type B

1. Crushed Stone

Thoroughly washed, clean, sound, tough, hard, crushed stone free from coatings meeting requirements for No. 57 Coarse Aggregate in Section 901 of the NJDOT specifications. It shall have a gradation by weight of the following:

<u>% Passing</u>	<u>Sieve</u>
100	1½-inch
95-100	1-inch
25-60	½-inch
0-10	No. 4
0-5	No. 8

C. Type C

1. Washed Sand

Washed coarse sand having the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	3/8-inch
95 - 100	No. 4
80 - 100	No. 8
50 - 85	No. 16
25 - 60	No. 30
10 - 30	No. 50
2 - 10	No. 100

D. Type D

1. Run-of-Bank Gravel

Run-of-bank gravel or other acceptable granular material free from organic matter with a gradation by weight of 100% passing a 1-1/2 inch square opening, 30 to 65% passing a 1/4 inch square opening, and not more than 10% passing a No. 200 mesh sieve.

E. Type E

1. A hard durable stone having the following gradation by weight meeting the requirements of I-2 Soil Aggregate in Section 901 of the NJDOT specifications.

% Passing

Sieve

100
65 - 100
40 - 75
5 - 30
0 - 7

2-inch
3/4-inch
No. 4
No. 50
No. 200

F. Type F

1. A mixture of Type D material and Portland cement mixed in a ratio of 15:1 and placed and compacted in a dry state.

G. Type G

1. A broadly graded sand or stone free from organic matter meeting the requirements of I-1 Soil Aggregate in Section 901 of NJDOT specifications with the following gradation by weight.

% Passing

Sieve

100
70 - 100
50 - 95
25 - 75
5 - 25
0 - 7

4-inch
2-inch
3/4-inch
No. 4
No. 50
No. 200

H. Type H

1. Pea Gravel

Pea gravel, consisting of a clean, washed, naturally rounded aggregate with a mix of particle sizes not less than 1/8-inch or more than 3/4-inch thick meeting the requirements of No. 6 Coarse Aggregate in Section 901 of NJDOT specifications.

I. Type I

1. Grouted Rip Rap

Grouted Rip Rap shall consist of rip rap material with all spaces between the stones filled with cement grout. The grout shall consist of one part cement conforming to the requirements of Portland Cement Type 2 and three parts fine aggregate, conforming to the requirements of type C material.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation

1. Lining as specified or directed for pipeline embedment shall be placed in accordance with the Section entitled "Trenching, Backfilling and Compacting".
2. Special Backfill where specified or directed shall be placed in accordance with the backfilling provisions of the Section entitled "Trenching, Backfilling and Compacting" and the Section entitled "Earthwork".

B. Disposal of Displaced Materials

1. Materials displaced through the use of the above materials shall be wasted or disposed of by the Contractor at no additional cost to the State.

3.02 SETTLEMENTS

- A. Any settlement in the finished work that occurs prior to Substantial Completion shall be corrected by the Contractor at his own cost and expense.

- END OF SECTION -

SECTION 02260

SHALLOW GROUND WATER RECOVERY WELLS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of nineteen ground water recovery wells constructed in accordance with the Contract Drawings and these Specifications.
2. Testing of the wells for plumbness and straightness.

B. Related Work Specified Elsewhere

1. Decontamination Protocol: Section 01140

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the test by basis designation only.

A. American Society of Testing and Materials (ASTM).

ASTM C150-89, Type 2 Portland Cement

B. American Petroleum Institute (API)

1.03 SUBMITTALS

A. Permits

B. Drilling logs

C. As-builts

PART 2 PRODUCTS

2.01 RECOVERY WELL CASING

- A. The well casing shall be constructed of new 6.625 inch outside diameter and minimum 6.065-inch inside diameter steel well casing with 0.156 inch minimum wall thickness.

2.02 RECOVERY WELL SCREEN

- A. The well screen shall be constructed of stainless steel continuous slot wound wire. The screen slot size is 0.010 inches.

2.03 FILTER PACK

- A. The material used for the filter pack should meet these specifications for the commercially available Morie #00 or an equivalent filter pack:

<u>Grain Size</u>	<u>Percent Retained</u>
0.3 mm	100%
0.6 mm	50%
0.65 mm	30%
0.75 mm	10%

2.04 BENTONITE SLURRY

- A. The bentonite slurry shall consist of a mixture of bentonite and water. The mixture will consist of 1 gallon of water per 1.5 pounds of bentonite.

2.05 RECOVERY WELL GROUT

- A. The grout material shall consist of a mixture of Portland Cement (ASTM C150-89, Type 2) and 10% bentonite (by volume).

PART 3 EXECUTION

3.01 RECOVERY WELL CONSTRUCTION

- A. Nineteen wells shall be constructed in accordance with the Contract Drawings and these Specifications. Wells shall be constructed using mud, air rotary, down-hole percussion hammer, or cable tool drilling methods. Drilling shall continue 4 feet into competent bedrock.

3.02 RECOVERY WELL CASING

- A. A minimum five foot section of blank casing shall be installed at the bottom of each well to accommodate the pump. The annular bedrock space shall be filled with grout material to seal the bedrock borehole. A tremie pipe shall be used to install grout to the top of bedrock depth.
- B. Casing lengths shall be joined water-tight using threaded and coupled or welded joints. Couplings shall meet API or equivalent specifications.

3.03 RECOVERY WELL SCREEN

- A. Well screen shall be installed so as to screen across the entire saturated zone within the saprolite. This will result in screen lengths ranging from approximately 20 to 40 feet, depending upon exact well locations and conditions encountered during drilling.
- B. Well screen sections shall be joined water tight using threaded and coupled, or welded joints. Couplings shall meet API or

equivalent specifications. The well screen shall be joined water tight to the casing using threaded and coupled joints or by welding.

3.04 FILTER PACK

- A. The well screen shall be packed with a suitable filter pack to a minimum of two feet above the top of the screen. The filter pack should be settled by pumping water from a controlled source into the well and forcing the water to come up through the filter pack. Additional filter sand shall then be added to the well annulus to bring the filter pack height up to a minimum of 2 feet above the top of the screen.

3.05 BENTONITE SLURRY

- A. A bentonite slurry shall be installed within the annular space above the sand pack using a tremie pipe. The bentonite slurry shall be installed by lowering the tremie pipe inside the annular space to the depth of the top of the sand pack and raising the pipe slowly as the bentonite slurry is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the bentonite slurry until the zone is sufficiently filled.

3.06 WELL PLUMBNESS AND ALIGNMENT

- A. The completed well shall be sufficiently plumb and straight.
- B. The well shall be tested for plumbness with a plummet. The maximum allowable horizontal deviation from the well from the vertical shall not exceed 4 inches per 100 feet of depth.
- C. Should the plumbness or alignment tests fail to meet the specifications described above, the plumbness and alignment shall be corrected by the Contractor at his own expense.

3.07 WELL DEVELOPMENT

- A. The well is to be developed to bring the well to its maximum production capacity, optimize well efficiency, and control suspended solids. Well development shall utilize hydraulic jetting, air development methods, surge block and/or pumping. The method(s) to be utilized will be at the discretion of the contractor with approval from the supervising Engineer prior to implementation.
- B. Well development shall continue until the well yields relatively clear sediment free water as approved by the Engineer.
- C. During development, efforts shall be made to minimize the amount of water discharged to the ground surface. The discharged water shall not be allowed to flow down grade. The development water

shall be allowed to seep naturally into the landfill until completely dissipated as directed by the Engineer.

- D. At the completion of development, approximately two linear feet of casing shall be extended above ground surface and then securely capped and locked until incorporated into the Ground Water Collection System. If the well is to be flush with the ground surface, the casing shall be extended to slightly below grade and then securely capped and locked until incorporated into the Ground Water Collection System.

3.08 POST DECONTAMINATION

A. General

- 1. Following drilling and dewatering activities, the Contractor shall decontaminate all wetted equipment per the decontamination protocol.

3.09 PERMANENT MARKER

- A. A permanent marker placed on a 7-ft. steel fence post embedded a minimum of 3 ft. in the ground shall be installed adjacent to each shallow ground water recovery well. Each permanent marker shall bear the well designation and the type of pump installed in the well.

- END OF SECTION -

SECTION 02263

GROUND WATER MONITOR WELLS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of eleven monitor wells in accordance with the Contract Drawings and these Specifications.
2. Testing of wells for plumbness and straightness.

B. Relate Work Specified Elsewhere

1. Decontamination Protocol: Section 01140

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the test by basis designation only.

A. American Society of Testing and Materials (ASTM)

ASTM C150-89, Type 2 Portland Cement

B. American Petroleum Institute (API)

1.03 SUBMITTALS

A. Permits

B. Drilling Logs

C. As-Builts

PART 2 PRODUCTS

2.01 GROUND WATER MONITOR WELL CASING

- A. The well casing shall be constructed of new schedule 40, 4-inch I.D. PVC.

2.02 GROUND WATER MONITOR WELL SCREEN

- A. The well screen shall be constructed of schedule 40, 4-inch I.D. PVC screen with a screen slot size of 0.010 inches.

2.03 FILTER PACK

- A. The material used for the filter pack should meet these specifications for the commercially available Morie #00 or an equivalent filter pack:

<u>Grain Size</u>	<u>Percent Retained</u>
0.3 mm	100%
0.6 mm	50%
0.65 mm	30%
0.75 mm	10%

2.04 BENTONITE SLURRY

- A. The bentonite slurry shall consist of a mixture of bentonite and water. The mixture will consist of 1 gallon of water per 1.5 pounds of bentonite.

2.05 CEMENT/BENTONITE GROUT

- A. The grout material shall consist of a mixture of Portland Cement (ASTM C150-89, Type 2) and 10% bentonite (by volume).

PART 3 EXECUTION

3.01 GROUND WATER MONITOR WELL CONSTRUCTION

- A. Twenty monitor wells shall be constructed in accordance with the Contract Drawings and these Specifications. Wells shall be constructed using mud, air rotary, down-hole percussion hammer, hollow-stem auger or cable tool drilling methods. Monitoring wells will be drilled 4 feet into bedrock where drilling equipment allows. Bedrock boreholes will be sealed with a cement/bentonite grout prior to monitoring well installation.

3.02 CEMENT/BENTONITE GROUT

Grout material shall be installed to seal the bedrock borehole by using a tremie pipe. The grout shall be installed by lowering the tremie pipe to the bottom of the boring and raising the pipe slowly as the grout is tremied. The discharge end of the tremie pipe shall remain submerged until grout is level with the top of bedrock depth.

3.03 GROUND WATER MONITOR WELL CASING

- A. A permanent nominal 8-inch diameter protective well casing shall be installed in accordance with the Contract Drawings or as directly by the Engineer.
- B. Casing lengths shall be joined water-tight using threaded and coupled joints. Couplings shall meet API or equivalent specifications.

3.04 GROUND WATER MONITOR WELL SCREEN

- A. Well screen shall be installed so as to screen across the entire saturated zone within the saprolite. This will result in screen lengths ranging from approximately 20 to 40 feet, depending upon exact well locations and conditions encountered during drilling.
- B. Well screen sections shall be joined threaded and coupled. Couplings shall meet API or equivalent specifications. The well screen shall be joined water tight to the casing using threaded and coupled joints.

3.05 FILTER PACK

- A. The well screen shall be packed with a suitable filter (sand) pack to a minimum of two feet above the top of the screen. The sand pack should be settled by pumping water from a controlled source into the well and forcing the water to come up through the sand pack. Additional filter sand shall then be added to the well annulus to bring the sand pack height up to a minimum of two feet above the top of the screen.

3.06 BENTONITE SLURRY

- A. Bentonite slurry shall be installed within the annular space above the sand pack using a tremie pipe. The bentonite slurry shall be installed by lowering the tremie pipe inside the annular space to the depth of the top of the sand pack and raising the pipe slowly as the bentonite slurry is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the bentonite slurry until the zone is sufficiently filled.

3.07 GROUND WATER MONITOR WELL PLUMBNESS AND ALIGNMENT

- A. The completed well shall be sufficiently plumb and straight.
- B. The well shall be tested for plumbness with a plummet. The maximum allowable horizontal deviation from the well from the vertical shall not exceed 4 inches per 100 feet of depth.
- C. Should the plumbness or alignment tests fail to meet the specifications described above, the plumbness and alignment shall be corrected by the Contractor at his own expense.

3.08 PROTECTIVE WELL CASING

- A. A permanent 5 ft. long nominal 8-inch diameter protective well casing shall be installed as shown on the Contract Drawings or as directed by the Engineer.

3.09 GROUND WATER MONITOR WELL DEVELOPMENT

- A. The well is to be developed to bring the well to its maximum production capacity, optimize well efficiency, and control suspended solids. Well development shall utilize hydraulic jetting, air development methods, surge block and/or pumping. The method(s) to be utilized will be at the discretion of the contractor with approval from the Engineer prior to implementation.
- B. Well development shall continue until the well yields relatively clear sediment free water as approved by the Engineer.
- C. During development, efforts shall be made to minimize the amount of water discharged to the ground surface. The discharged water shall not be allowed to flow down grade. The development water shall be allowed to seep naturally into the landfill until completely dissipated as directed by the Engineer.
- D. At the completion of development, approximately two linear feet of casing shall be extended above ground surface and then securely capped and locked. If the well is to be flush with the ground surface, the casing shall be extended to slightly below grade and then securely capped and locked.

3.10 POST DECONTAMINATION

A. General

- 1. Following drilling and dewatering activities, the Contractor shall decontaminate all wetted equipment per the decontamination protocol.

- END OF SECTION -

SECTION 02265

PIEZOMETERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of twenty-eight piezometers in accordance with the Contract Drawings and these Specifications.
2. Testing of piezometers for plumbness and straightness.

B. Related Work Specified Elsewhere

1. Decontamination Protocol: Section 01140.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. American Society of Testing and Materials (ASTM). The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the test by basis designation only.

ASTM C150-89, Type 2 Portland Cement

- B. American Petroleum Institute (API)

1.03 SUBMITTALS

- A. Permits
- B. Drilling logs
- C. As-builts

PART 2 PRODUCTS

2.01 PIEZOMETER CASING

- A. The piezometer casing shall be constructed of schedule 40 PVC casing. Piezometers installed on the landfill face will be constructed of 6-inch I.D. PVC, while those surrounding the cap will be composed of 2-inch I.D. PVC.

2.02 PIEZOMETER SCREEN

- A. The piezometer screen shall be constructed of schedule 40 PVC of the same diameter as the attached well casing. The proposed screen slot size is 0.010 inches.

2.03 FILTER PACK

- A. The material used for the filter pack should meet these specifications for the commercially available Morie #00 or an equivalent filter pack:

<u>Grain Size</u>	<u>Percent Retained</u>
0.3 mm	100%
0.6 mm	50%
0.65 mm	30%
0.75 mm	10%

2.04 BENTONITE SLURRY

- A. The bentonite slurry shall consist of a mixture of bentonite and water. The mixture will consist of 1 gallon of water per 1.5 pounds of bentonite.

2.05 GROUT

- A. The grout material shall consist of a mixture of Portland Cement (ASTM C150-89, Type 2) and 10% bentonite (by volume).

PART 3 EXECUTION

3.01 PIEZOMETER CONSTRUCTION

- A. Twenty-seven piezometers shall be constructed in accordance with the Contract Drawings and these Specifications. Eight of these piezometers will be installed on the face of the landfill. Wells shall be constructed using mud, air rotary, down-hole percussion hammer, hollow-stem auger or cable tool drilling methods. Piezometers will be drilled to competent bedrock or 4 feet into bedrock where drilling equipment allows. Bedrock boreholes will be sealed with a cement/bentonite grout prior to piezometer installation.

3.02 CEMENT/BENTONITE GROUT

- A. Grout material shall be installed to seal the bedrock borehole by using a tremie pipe. The grout shall be installed by lowering the tremie pipe to the bottom of the boring and raising the pipe slowly as the grout is tremied. The discharge end of the tremie pipe shall remain submerged until grout is level with the top of bedrock depth.

3.03 PIEZOMETER CASING

- A. A permanent protective casing shall be installed in accordance with the Contract Drawings or as directed by the Engineer. The casing should be a nominal 6-inch diameter for 2-inch piezometers, and a nominal 10-inch diameter for 6-inch piezometers.

- B. Casing lengths shall be joined water-tight using threaded and coupled joints. Couplings shall meet API or equivalent specifications.

3.04 PIEZOMETER SCREEN

- A. Piezometer screen shall be installed so as to screen across the entire saturated zone within the saprolite. This will result in screen lengths ranging from approximately 20 to 40 feet, depending upon exact well locations and conditions encountered during drilling.
- B. Piezometer screen sections shall be joined threaded and coupled joints. Couplings shall meet API or equivalent specifications. The well screen shall be joined water tight to the casing using threaded and coupled joints.

3.05 FILTER PACK

- A. The well screen shall be packed with a suitable filter pack to a minimum of two feet above the top of the screen. The filter pack should be settled by pumping water from a controlled source into the well and forcing the water to come up through the filter pack. Additional filter sand shall then be added to the well annulus to bring the filter pack height up to a minimum of 2 feet above the top of screen.

3.06 BENTONITE SLURRY

- A. A bentonite slurry shall be installed within the annular space above the sand pack using a tremie pipe. The bentonite slurry shall be installed by lowering the tremie pipe inside the annular space to the depth of the top of the sand pack and raising the pipe slowly as the bentonite slurry is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the bentonite slurry until the zone is sufficiently filled.

3.07 PIEZOMETER PLUMBNESS AND ALIGNMENT

- A. The completed piezometer shall be sufficiently plumb and straight such that there is not interference with the possible installation of the permanent well pump.
- B. The piezometer shall be tested for plumbness with a plummet. The maximum allowable horizontal deviation from the well from the vertical shall not exceed 4 inches per 100 feet of depth.
- C. Should the plumbness or alignment tests fail to meet the specifications described above, the plumbness and alignment shall be corrected by the Contractor at his own expense.

3.08 PIEZOMETER DEVELOPMENT

- A. The piezometer is to be developed to bring the well to its maximum production capacity, optimize piezometer efficiency, specific capacity and control suspended solids. Piezometer development shall utilize hydraulic jetting, air development methods, surge block and/or pumping. The method(s) to be utilized will be at the discretion of the contractor with approval from the Engineer prior to implementation.
- B. Well development shall continue until the well yields relatively clear sediment free water as approved by the Engineer.
- C. During development, efforts shall be made to minimize the amount of water discharged to the ground surface. The discharged water shall not be allowed to flow down grade. The development water shall be allowed to seep naturally into the landfill until completely dissipated as directed by the Engineer.
- D. At the completion of development, approximately two linear feet of casing shall be extended above ground surface and then securely capped and locked. If the well is to be flush with the ground surface, the casing shall be extended to slightly below grade and then securely capped and locked.

3.09 POST DECONTAMINATION

A. General

- 1. Following drilling and dewatering activities, the Contractor shall decontaminate all wetted equipment per the decontamination protocol.

- END OF SECTION -

SECTION 02267
BEDROCK MONITOR WELLS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of six bedrock monitor wells in accordance with the Contract Drawings and these Specifications.
2. Testing of the wells for plumbness and straightness.

B. Related Work Specified Elsewhere

1. Decontamination Protocol: Section 01140.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the test by basis designation only.

A. American Society of Testing and Materials (ASTM).

ASTM C150-89, Type 2 Portland Cement

B. American Petroleum Institute (API)

1.03 SUBMITTALS

A. Permits

B. Drilling logs

C. As-builts

PART 2 PRODUCTS

2.01 BEDROCK MONITOR WELL CASING

- A. The well casing shall be constructed of new 6-inch inside diameter steel well casing.

2.02 CEMENT/BENTONITE GROUT

- A. The grout material shall consist of a mixture of Portland Cement and 10% bentonite (by volume).

PART 3 EXECUTION

3.01 BEDROCK MONITOR WELL CONSTRUCTION

Six wells shall be constructed in accordance with the Contract Drawings and these specifications. Wells shall be constructed using mud, air rotary, down-hole percussion hammer or cable tool drilling methods, with an oversize borehole a minimum of 4 inches greater than the casing diameter.

3.02 BEDROCK MONITOR WELL CASING

- A. Casing shall be installed through the overburden and shall be set 10 feet into competent bedrock. The casing shall extend to approximately 2 feet above grade unless the well is to be flush-mounted.

3.03 CEMENT/BENTONITE GROUT

A cement/bentonite grout shall be installed within the annular space the entire length of the steel well casing using a tremie pipe. The grout shall be installed by lowering the tremie pipe inside the annular space to the bottom of the boring (10 ft. into bedrock) and raising the pipe slowly as the grout is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the grout until the zone is sufficiently filled.

3.04 BEDROCK DRILLING

Once the casing is set 10 feet into competent bedrock, and the grout has set for a minimum of 24 hours, drilling shall be continued for 25 additional feet to produce a 6-inch diameter open-bedrock hole.

3.05 WELL PLUMBNESS AND ALIGNMENT

- A. The completed well shall be sufficiently plumb and straight.
- B. The well shall be tested for plumbness with a plummet. The maximum allowable horizontal deviation from the well from the vertical shall not exceed 4 inches per 100 feet of depth.
- C. Should the plumbness or alignment tests fail to meet the specifications described above, the plumbness and alignment shall be corrected by the Contractor at his own expense.

3.06 WELL DEVELOPMENT

- A. The well is to be developed to bring the well to its maximum production capacity, optimize well efficiency, and control suspended solids. Well development shall utilize hydraulic jetting, air development methods, surge block and/or pumping. The method(s) to be utilized will be at the discretion of the contractor with approval from the supervising Engineer prior to implementation.

- B. Well development shall continue until the well yields relatively clear sediment free water as approved by the Engineer.
- C. During development, efforts shall be made to minimize the amount of water discharged to the ground surface. The discharged water shall not be allowed to flow down grade. The development water shall be allowed to seep naturally into the landfill until completely dissipated as directed by the Engineer.
- D. At the completion of development, the well shall be securely capped and locked. If the well is to be flush with the ground surface, the casing shall be extended to slightly below grade and then securely capped and locked.

- END OF SECTION -

SECTION 02268

OFF-SITE BEDROCK MONITOR WELLS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of nine off-site monitor wells in accordance with the Contract Drawings. These wells will be installed at three locations with a cluster of three wells at each location as specified by the NJDEP. These wells will be located off-site on the following properties.

3 wells Chester Twp. Block 16.01 Lot 1

6 wells Washington Twp. Block 42 Lot 5

2. Testing of wells for plumbness and straightness.

B. Related Work Specified Elsewhere

1. Decontamination Protocol: Section 01140.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the test by basis designation only.

A. American Society of Testing and Materials (ASTM).

ASTM C150-89, Type 2 Portland Cement

B. American Petroleum Institute (API)

1.03 SUBMITTALS

A. Permits

B. Drilling logs

C. As-builts

PART 2 PRODUCTS

2.01 OFF-SITE BEDROCK MONITOR WELL CASING

- A. The outer well casing shall be constructed of new 8-inch inside diameter steel well casing.

- B. The inner well casing shall be constructed of new 6-inch inside diameter steel well casing.

2.02 BENTONITE SLURRY

- 1. The bentonite slurry shall consist of a mixture of bentonite and water in a ratio of 1 gallon of water per 1.5 pounds of bentonite.

2.03 CEMENT/BENTONITE GROUT

- A. The grout material shall consist of a mixture of Portland Cement and 10% bentonite (by volume).

PART 3 EXECUTION

3.01 OFF-SITE BEDROCK MONITOR WELL CONSTRUCTION

Nine wells shall be constructed in accordance with the Contract Drawings and these Specifications. Each well location shall consist of a cluster of three wells spaced between 10 and 20 feet apart. The wells shall be installed in a line trending northeast - southwest, aligned on the following order: shallow-intermediate-deep. The deep well of each cluster shall be the closest well to Trout Brook. At each well location, the deep monitor well will be installed first by drilling a pilot hole (minimum diameter of 4-inches) 200 feet into competent bedrock.

Subsequent to drilling the above pilot holes, all three pilot holes should be geophysically logged. The pilot holes should be logged using the following geophysical methods: 1) three arm caliper; 2) sonic/acoustic; and 3) single point resistance. The requested geophysical logging (see below) must begin within three working days after completion of the third pilot hole.

The Engineer shall evaluate the driller's logs, lithologic logs and geophysical logs of the pilot holes and propose depths for the 25 foot open borehole for each of the 9 wells. A legible copy of the driller's logs, the lithologic logs and the results of the geophysical logging must be submitted to the Bureau of Ground Water Pollution Abatement within four days from the completion of the geophysical logging. An interpretation of the pilot hole logs and the proposed open borehole depths shall accompany the above material.

The Department must approve the proposed depth of the open borehole intervals before any of the wells can be completed. Conversion of the pilot holes into deep monitor wells must begin within 10 working days from the completion of geophysical logging.

3.02 OFF-SITE BEDROCK MONITOR WELL CASING.

- A. The outer casing shall be installed through the overburden and shall be set 10 feet into competent bedrock. The casing shall extend to approximately 2 feet above grade unless the well is to be flush-mounted. Subsequent to installation of the outer

casing, the outer casing must be pressure grouted into the borehole. The inner casing shall extend to the top of the open borehole interval.

- B. Subsequent to the installation of the inner casing, the bottom of the well must be blown out to remove debris that had fallen into the borehole during reaming of the pilot hole for the installation of the inner casing.

After the inner casing has been set and the bottom of the borehole has been blown out, the bottom of the pilot hole must be tremie grouted up to the bottom of the chosen open borehole interval with a bentonite slurry.

Subsequent to the bottom of the pilot hole being grouted, one foot of medium sand must be placed over the bentonite slurry.

3.03 BENTONITE SLURRY

A bentonite slurry shall be installed in the pilot hole up to the bottom of the chosen open borehole interval. The bentonite slurry shall be installed by lowering the tremie pipe to the bottom of the pilot hole and raising the pipe slowly as the bentonite slurry is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the bentonite slurry until the zone is sufficiently filled.

3.04 CEMENT/BENTONITE GROUT

A cement/bentonite grout shall be installed within the annular space the entire length of the steel well casing using a tremie pipe. The grout shall be installed by lowering the tremie pipe inside the annular space to the bottom of the boring and raising the pipe slowly as the grout is tremied. The tremie pipe shall remain full continuously from the start to the finish of the procedure. The discharge end of the tremie pipe shall remain submerged in the grout until the zone is sufficiently filled.

3.05 BEDROCK DRILLING

Once the casing is set 10 feet into competent bedrock, and the grout has set for a minimum of 24 hours, drilling shall be continued for 25 additional feet to produce a 4-inch diameter open-bedrock hole.

Each well shall have an open borehole length of 25 feet. If the proposed open bore hole interval does not yield 2 gpm or more, the open bore hole interval should be extended to a length at which a yield of 2 gpm is obtained or the open bore hole interval reaches 50 feet in length. The open bore hole interval shall not exceed 50 feet in length without permission by NJDEP.

3.06 WELL PLUMBNESS AND ALIGNMENT

- A. The completed well shall be sufficiently plumb and straight.
- B. The well shall be tested for plumbness with a plummet. The maximum allowable horizontal deviation from the well from the vertical shall not exceed 4 inches per 100 feet of depth.
- C. Should the plumbness or alignment tests fail to meet the specifications described above, the plumbness and alignment shall be corrected by the Contractor at his own expense.

3.07 WELL DEVELOPMENT

- A. The well is to be developed to bring the well to its maximum production capacity, optimize well efficiency, and control suspended solids. Well development shall utilize hydraulic jetting, air development methods, surge block and/or pumping. The method(s) to be utilized will be at the discretion of the contractor with approval from the supervising Engineer prior to implementation.
- B. Well development shall continue until the well yields relatively clear sediment free water as approved by the Engineer.
- C. During development, efforts shall be made to minimize the amount of water discharged to the ground surface. The discharged water shall not be allowed to flow down grade. The development water shall be allowed to seep naturally into the landfill until completely dissipated as directed by the Engineer.
- D. At the completion of development, the well shall be securely capped and locked. If the well is to be flush with the ground surface, the casing shall be extended to slightly below grade and then securely capped and locked.

- END OF SECTION -

SECTION 02270

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. The work specified herein shall consist of the preparation and implementation of a Site Specific Soil Erosion and Sediment Control Plan. The Site Specific Soil Erosion and Sediment Control Plan shall present operations to be performed by the contractor to control sediment and minimize erosion of soils into drainage channels and lands adjacent to or affected by the work. The Contractor shall submit his erosion and sedimentation plan to the Morris County Soil Conservation District, pay the required fee and obtain certification of the plan by the Morris County Soil Conservation District. The Contractor must comply with all components of the certified plan during construction. The Contractor shall submit two (2) copies of the certified plan to the State and two (2) copies of the certified plan to the Engineer for review prior to implementation.

B. Related Work Specified Elsewhere

1. Earthwork: Section 02220
2. Embankment: Section 02222
3. Topsoil and Seeding: Section 02980
4. Soil Barrier Layer: Section 02290
5. Soil Barrier Layer with Bentonite: Section 02291
6. Drainage Layer: Section 02292
7. Vegetative Layer: Section 02293

1.02 SUBMITTALS

- A. Site Specific Soil Erosion and Sediment Control Plan
- B. Shop Drawings of erosion control fencing.
- C. The Contractor shall submit seed vendor's certified statement for the grass seed to be used for erosion control purposes stating common name, scientific name, percentage by weight, and percentages of purity and germination.

1.03 REGULATORY REQUIREMENTS

- A. The Site Specific Soil Erosion and Sediment Control Plan shall be consistent with the requirements and guidelines of "Standards for Soil Erosion and Sediment Control in New Jersey", April 1987, by the New Jersey State Soil Conservation Committee.

Vegetative and Structural Standards presented in this document, pages 3.1.1 to 4.20.2 inclusive, are promulgated as "Standards" pursuant to the Soil Erosion and Sediment Control Act of 1975 as amended, (NJSA 4:24-42), and New Jersey Administrative Code, (NJAC 2:90-1.1 et seq.).

1. The Vegetative Standards shall include the following standards as a minimum:
 - Temporary Vegetative Cover for Soil Stabilization
 - Permanent Vegetative Cover for Soil Stabilization
 - Stabilization with Mulch Only
 - Permanent Stabilization with Sod
 - Topsoiling
 - Maintaining Vegetation
 - Trees, Shrubs, and Vines
 - Protecting Trees During Construction
2. The Structural Standards shall include the following standards as a minimum:
 - Land Grading
 - Diversions
 - Grassed Waterway
 - Sediment Basin
 - Slope Protection Structures
 - Channel Stabilization
 - Detention Basin
 - Subsurface Drainage
 - Traffic Control
 - Dust Control
 - Lined Waterway
 - Riprap
 - Sediment Barrier
 - Conduit Outlet Protection
 - Stabilization Construction Entrance
 - Storm Sewer Inlet Protection
 - Grade Stabilization Structure

PART 2 PRODUCTS

2.01 TEMPORARY VEGETATIVE COVER

Seed used for temporary cover shall meet the requirements of the Standard for Temporary Vegetative Cover for Soil Stabilization presented in Standards for Soil Erosion and Sediment Control in New Jersey. Final seeding shall meet the requirements of Section: Topsoil and Seeding contained in these specifications.

2.02 SEDIMENT BARRIERS

Sediment barriers, including hay bales, silt fences, and stone barriers shall meet the requirements of the Standard for Sediment Barrier presented in Standards for Soil Erosion and Sediment Control in New Jersey, and as shown in the Design Drawings.

PART 3 EXECUTION

3.01 SITE SPECIFIC SOIL EROSION AND SEDIMENT CONTROL PLAN

The Contractor shall develop and submit a Site Specific Soil Erosion and Sediment Control Plan for certification to the Morris County Soil Conservation District (SCD). The Contractor shall submit his erosion and sedimentation plan to the Morris County Soil Conservation District, pay the required fee and obtain certification of the plan by the Morris County Soil Conservation District. The Contractor must comply with all components of the certified plan during construction. The Contractor shall submit two (2) copies of the certified plan to the State and two (2) copies of the certified plan to the Engineer for review prior to implementation. The Site Specific Soil Erosion and Sediment Control Plan shall be submitted to the Morris County SCD a within 28 days of receipt of Notice of Award but no later than 45 days prior to the start of site construction activities. In addition, the Contractor shall also submit for acceptance at the same time, his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of excavated spoil. No construction activities shall be initiated until the Site Specific Soil Erosion and Sediment Control Plan, erosion control schedules and methods of operations have been accepted by the SCD. If conditions change during construction, the Contractor may be required to submit a revised plan for acceptance as directed by the State. The objective of the Site Specific Soil Erosion and Sedimentation plan is to retain soil on site and minimize delivery of sediment offsite.

A. The following factors are to be evaluated by the Contractor prior to preparation of the Site Specific Soil Erosion and Sediment Control Plan:

1. Erodibility of soils (soil characteristic information may be referenced in the USDA "Soil Survey").
2. Existing drainage patterns.
3. Presence of steep slopes, stream corridors and other critical site factors.
4. Quality of existing vegetation to act as a buffer during construction.
5. Minimum area to be cleared.
6. Protection of roadway access points from tracking sediments.
7. Need for protecting conduit outlets with riprap.
8. Stabilization of excess excavated materials to be deposited offsite.
9. An offsite stability analysis performed to demonstrate that a stable condition exists at all points of water

discharge for the 2 and 10 year design storm. If the existing offsite conditions are currently unstable it must be demonstrated that the project will not aggravate the offsite conditions.

10. A stable emergency discharge area must be provided for all Infiltration Basins proposed by the Contractor for storm water management such that the project will not aggravate the offsite conditions.

B. The following factors are to be included in the erosion control plan:

1. The grades, maximum slope and maximum area to be disturbed at one time should be based on: soil erodibility, geology, rainfall data, proposed establishment of temporary or permanent vegetation, proposed maintenance.
2. The sequence of construction and the installation of erosion controls including, site clearing, topsoil stripping, interim control installation, construction of structures/project phase, maintenance of controls.
3. Controls designed to achieve the following:
 - interception of runoff from side slopes and delivery to a stable area
 - stabilization by use of temporary vegetation
 - sediment filtration via preserving buffer strips
 - stabilized stockpiled soil
 - control soil losses at driveway entrances/exits; streams, rivers, natural drainage ways; large, cleared areas subject to wind erosion.
4. Provisions for the availability of extra erosion control materials, including as a minimum silt fence, hay bales, and rip rap for use in the event that an unforeseen situation should arise requiring emergency action.

C. These provisions are to be included in the contractor's Site Specific Soil Erosion and Sediment Control Plan:

1. Earthwork shall not be initiated at a given location until the method and sequencing of all operations are approved by the Engineer. The Contractor shall schedule and conduct his operations to minimize erosion of soils and to minimize silting and muddying of drainage channels, and lands adjacent to or affected by the work. Construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations.
2. The Engineer or Construction Manager has the authority to limit the surface area of erodible earth material exposed

by clearing and grubbing, excavation of borrow, and fill operations and to direct the Contractor to provide immediate erosion control measures to minimize damage to adjacent property and to minimize silting or muddying of adjacent streams or drainage channels.

3. The Contractor shall include in his Site Specific Soil Erosion and Sediment Control Plan a schedule of implementation of soil erosion and sediment control measures. The Contractor will be required to incorporate all erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed such that grading operations and erosion control features can follow immediately thereafter.
4. During construction, both cut and fill earth slopes shall be seeded, in accordance with applicable guidelines, as soon as possible following cessation of activities in that area. If activities are to cease for a period of 30 days or more and then be resumed, temporary seeding, it shall be installed in accordance with the applicable guidelines unless otherwise directed by the Engineer or Construction Manager.
5. The Contractor shall provide and maintain slopes, crowns and ditches on all excavation and embankments to insure satisfactory surface drainage at all times. Ditches and other drainage facilities necessary to remove ponded water shall be constructed as soon as practical to have the work area dry during the progression of work. All existing culverts and drainage systems shall be maintained in satisfactory operating condition throughout the course of the work unless otherwise directed by the Engineer. If it is necessary to interrupt existing surface drainage, then temporary drainage facilities shall be provided until the permanent drainage work is complete.
6. During construction, both cut and fill earth slopes shall be seeded, as specified in the contract, as soon as possible.
7. The Contractor shall provide and maintain slopes, crowns and ditches on all excavation and embankments to insure satisfactory surface drainage at all times. Ditches and other drainage facilities necessary to remove ponded water shall be constructed as soon as practical to have the work area dry during the progression of work. All existing culverts and drainage systems shall be maintained in satisfactory operating condition throughout the course of the work unless otherwise directed by the Engineer. If it is necessary to interrupt existing surface drainage, then temporary drainage facilities shall be provided until the permanent drainage work is complete.

8. In carrying out erosion control measures, the Contractor will be guided by, but not limited to, the following controls:
- a. When borrow material is obtained, erosion of the borrow area shall be so controlled both during and after completion of the work, such that erosion will be minimized and sediment entering drainage channels or adjacent properties will be minimized. Spoil areas and construction roads shall be located, constructed and maintained in a manner that will minimize sediment entering drainage channels. The Contractor shall submit grading plans for all spoil areas to the Engineer for acceptance prior to the start of work on, or the use of, such areas. The grading plans shall indicate the sequence of operations, temporary slopes and other factors which may have an influence on erosion control.
 - b. Frequent fording of drainage channels will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of crossings are necessary. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in drainage channels.

- END OF SECTION -

SECTION 02271

DUMPED RIP-RAP

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

The Contractor shall furnish and install dumped rip-rap, including subgrade excavation for such installation, to the lines and grades and depth shown on the Contract Drawings, ordered or specified.

B. Related Work Specified Elsewhere

1. Restoration of Surfaces: Section 02502
2. Select Fill: Section 02230

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

1. New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction Section 701-Aggregates. Appendix A-3 Soundness of Aggregates by Use of Sodium Sulfate.
2. ASTM D4644-State Durability of Shales and Similar Weak Rocks.

1.03 SUBMITTALS

A. The Contractor shall submit information on the source of this material and the results of any testing used to locate this material for approval of source. As a minimum, this information shall include a topographic map showing the location of the borrow source, the extent of excavation required to obtain the required quantities of materials, the location within the borrow source from which samples were collected for any laboratory testing, and the results of any laboratory testing performed to characterize soils from the borrow source. A copy of required mining permits must also be submitted to completely document the proposed borrow source.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide at least 2 days notice prior to sampling borrow source. The Contractor shall provide transportation for the Construction Manager and Engineer to and

from the borrow source in order that the Construction Manager and Engineer may witness borrow source sampling.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. Dumped Rip Rap shall be angular stone with the following gradation.

<u>Stone Filling Item</u>	<u>See Notes</u>	<u>Stone Size¹</u>	<u>Percent of Total by Weight</u>
Light (Min. 12 in. Thick)	1,2,3, 4,5,6,7	Lighter than 100 lbs. Larger than 6 ins. Smaller than 1/2 in.	90-100 50-100 0-10
Medium (Min. 18 in. Thick)	1,2,3, 5,6	Heavier than 100 lbs. Smaller than 4 ins.	50-100 0-10
Heavy	1,2,3, 6,7	Heavier than 600 lbs.	50-100

NOTES:

1. Rip-rap shall conform to the requirements of subsection 901.04 for ledge rock of NJDOT Specification Section 901.
2. A minimum of three samples of each type of rip-rap shall be tested for durability in accordance with ASTM D4644. Suitable materials shall be classified as Type I in accordance with this test. These samples shall also be tested for sodium sulfate soundness in accordance with Appendix A-3 of the NJDOT Standard Specification for Road and Bridge Construction. The proposed rip-rap shall show a maximum loss of 10% when tested for sodium sulfate soundness.
3. Stone size, other than weights, refer to the average of the maximum and minimum dimensions of a stone particle as estimated by the Engineer.
4. Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.
5. Cobbles or gravel having at least one fractured face per particle are acceptable substitutes for stone under these items, provided that soundness and gradation requirements are met.
6. Materials shall contain a sufficient amount of stones smaller than the average stone size to fill the spaces between the larger stones.
7. Heavier gradings of this item may be required on some projects, in which case the requirements will be stated on the plans or in the proposal.

PART 3 EXECUTION

3.01 PLACING

- A. Rip-rap bedding material shall be gradation designation I-5 at the thicknesses specified on the Contract Drawings.
- B. The stone shall be placed by either dumping or blading into place. Final adjustments shall be made manually as required to secure the stones and shape the face of the rip-rap.
- C. The stones shall be placed so that the weight of the stone is carried by the underlying material and not by the adjacent stones.
- D. One dimension of each of the stones furnished shall be approximately equal to the thickness of the rip-rap as shown on the Plans, and the stones shall be so laid that this dimension shall be perpendicular to the prepared bed.

- END OF SECTION -

SECTION 02280

DRUM REMOVAL

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Logging, sampling, analyzing, excavation, removing, working and transporting drums encountered during fill/refuse relocation operations, as shown or specified or as directed by the Engineer. Backfilling and compacting excavations resulting from drum removal.

B. Related Work Specified Elsewhere

1. Safety, Health, and Emergency response: Section 01110.
2. Decontamination Protocol: Section 01140.
3. Fill/Refuse Relocation: Section 02229
4. Earthwork: Section 02220
5. Embankment: Section 02222
6. Select Fill: Section 02230

1.02 TESTING

- ###### A.
- All testing required for drum removal shall be supplied by Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

- | | |
|---------------|---|
| ASTM D1557-78 | Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18 inch Drop |
| ASTM 2922-81 | Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth) |
| ASTM D3017-88 | Moisture Content of Soil and Soil-Aggregate In place by Nuclear Methods (Shallow Depth) |

- B. Occupational Safety and Health Administration (OSHA)
 - 29CFR Part 1910 Occupational Safety and Health Standards for General Industry
 - 29CFR Part 1926 Occupational Safety and Health Standards for Construction
- C. U.S. Department of Transportation (DOT)
 - 49CFR Part 173 DOT General Requirements for Shipments and Packaging
 - 49CFR Part 173.3 DOT Regulations for Packaging and Exceptions

1.04 SUBMITTALS

- A. The Contractor shall submit data for the following items required by this section:
 - 1. Sampling and Waste Characterization (SAWC) Plan (Prior to Fill/Refuse Relocation)
 - 2. Design of Staging area (Prior to Construction).
 - 3. Results of all chemical testing.
 - 4. Results of all evidence documentation.
 - 5. Results of all soil testing.

1.05 DEFINITIONS

- A. Contaminated Material
 - 1. Contaminated material shall be defined as free standing liquid, subsurface drums which may contain USEPA Hazardous Substance List (HSL) compounds.

PART 2 PRODUCTS

2.01 SAMPLING AND WASTE CHARACTERIZATION PLAN (SAWC)

The SAWC plan shall detail all procedures to be undertaken by the Contractor to handle, sample, and characterize drummed wastes. All procedures to be conducted under the SAWC Plan shall be in strict accordance with the HASP. As a minimum, the SAWC Plan shall include the following provisions:

- A. Staging, Inventory, Sampling
 - 1. Personnel

- a. The Contractor shall provide adequate manpower to stage, inventory, and sample all breached and intact drums in accordance with the approved Sampling and Waste Characterization (SAWC) Plan.
- b. Personnel involved in handling and transporting drummed waste shall work in teams containing no fewer than two people. Visual contact shall be maintained between members of the working team at all times. All team members shall be able to communicate between themselves and with the Health and Safety Officer by two-way radio during all times on the work site.
- c. Personnel shall at all times be equipped at the level of protection as specified by the Health and Safety Plan.

2. Equipment/Materials

- a. The Contractor shall provide adequate and proper equipment to stage, inventory, and sample all breached and intact drums in accordance with the approved Sampling and Waste Characterization (SAWC) Plan.
- b. Drums shall be handled with a grappler equipped backhoe, front end loader, or forklift. Alternate methods of segregating or lifting drums may be used subject to prior approval from the Contract Manager.
- c. All handling equipment shall be equipped with full frontal and side splash and explosion shields. Class ABC fire extinguishers shall be fitted to the body of each piece of equipment.
- d. Any equipment used for handling, opening, and sampling drums must be of the non-sparking type.

3. Handling and Evidence Documentation

- a. If, during excavation activities, an object which is suspected of being a drum is encountered, the Contractor shall notify the Engineer and Construction Manager so that an appraisal of the object and its condition may be made. If the Engineer and Construction manager determine that the object is not a drum or that its condition is so poor that evidence documentation would be nonproductive, the Contractor will be directed to handle the drum as either ordinary refuse/fill or, if partially full, in accordance with drum handling procedures in the approved SAWC Plan. If the drum is handled as ordinary refuse/fill, no additional payment will be made for drum removal.

- b. If the Engineer and Construction manager determine that the object is a drum and the preliminary appraisal of its condition indicates the possibility of evidence recovery, the Contractor will be directed by the Engineer and Construction Manager to perform evidence recovery procedures. Evidence recovery procedures will include photography in accordance with requirements set forth below. The drums shall then be staged, inventoried and sampled as described below.
- c. A minimum of 12 color photographs shall be taken of each drum subject to evidence documentation as identified by the Engineer and Construction Manager. The photographs shall be taken in place and at several stages during removal from the excavation. Following removal from the excavation, surfaces shall be cleaned to the extent possible, and photographs shall be taken of all surfaces with particular attention paid to any markings or labels. The Contractor shall deliver the negatives along with two 3 x 5 inch prints of each photograph to the State within seven days following photography. The prints shall be labelled on the back with all relevant data pertaining to the picture. The names and affiliations of all personnel witnessing the drum removal operation shall be placed on the photograph.
- d. Drums shall be staged, inventoried, and sampled in a designated work zone. Maximum care and caution shall be exercised when opening drums. All drums and mechanical equipment shall be grounded prior to the commencement of sampling. Initial storage shall be on the landfill adjacent to the excavation. The area of initial storage shall be shaped so that any leakage goes into the landfill.
- e. Before handling, the condition of each drums shall be determined and categorized as either open, leaning, bulging, empty, or a combination.
- f. Drums shall not be moved or opened unless an external/gross gamma scan is negative. If the readings show safe levels, then gamma, beta and alpha readings shall be taken from within one quarter (1/4) of an inch of the material's surface. Should elevated levels of radiation be encountered the Construction Manager, the Engineer, and the Contractor's Health and Safety Officer shall be notified.
- g. The drums that exhibit leakage or apparent deterioration such that movement will cause rupture, shall immediately have the contents transferred to

a secure container. Leaking drums containing sludges or semi-solids, drums that are structurally sound but which cannot be closed and contain potentially hazardous liquid or solid waste, and drums which are deteriorated but can be moved without rupture, shall be immediately placed in overpack drums of adequate size.

- h. Drums which potentially are under internal pressure, as evidenced by bulging, shall be sampled in place. Extreme care shall be exercised when working adjacent to potentially pressurized drums. Should movement of a pressurized drum be unavoidable, handling shall be by a grappler unit constructed for explosive containment. The bulged drum shall be moved only as far as necessary to allow seating on firm ground or shall be carefully overpacked. Openings into pressurized drums shall be plugged and the bung holes fitted with pressure venting caps set at 5 psi release.

- i. Inventory

After securing and opening a drum, a field chemist or field technician shall record the following information onto a drum inspection log or data sheet that indicates the sites names:

- (a) Physical state of materials: liquid, solid, sludge or powder and percentages thereof, including whether there are multiple layers of materials and their physical states and percentages thereof.
- (b) Color of materials.
- (c) Percent each drum is filled with materials, usually specified as 1/4, 1/2, 3/4, or completely full.
- (d) Condition of drum (intact, leaking, bulging, rusting, etc.)
- (e) Size and type of drum.
- (f) Size and type of overpack necessary (if any).
- (g) Inspection/sampling time and date.
- (h) Weather at time of inspection.
- (i) Drum number.

Note: Odor description is not a recommended observation due to the extremely toxic nature of any organic and inorganic substances.

5. Sampling

- a. If the bung of the drum can be removed, contained liquids shall be sampled by a glass thief, which shall be broken after sampling and discarded within the drum. A drum that has a badly rusted bung, or that cannot be opened by bung removal, shall be safely entered with a hydraulic penetrating device operated remotely. All openings shall be plugged except during sampling. Unanalyzed samples shall not be fixed with any preservative or preserved with ice or dry ice.
- b. All information concerning the sample's general field characteristics (such as field measurements, spot tests, pH including field pH and other observations, e.g., physical state, viscosity, fuming, layering, coloring, whether the substance is aqueous or non-aqueous etc.) shall be recorded in the master log. the field characterization should be conducted according to the approved Sampling and Waste Characterization (SAWC) Plan.
- c. Empty drums (containing less than 1 in. solid residue waste) or drums containing trash (tyveks, booties, garbage and debris, etc.) will not be sampled or tested. They will be marked and their contents recorded in the master log.
- d. The Contractor shall bulk these samples on site with regard to the following guidelines and with on site approval of the Construction Manager.
 - Step 1. Only samples from the same location may be bulked.
 - Step 2. Samples of the same phase may be bulked.
 - Step 3. Non-manufactured waste may be bulked (soils, muds, and water).
 - Step 4. Drums that fit the first three steps of this criteria will be given compatibility tests in composite samples that will not be made up from more than 10 individual drum samples.
- e. The State shall be notified immediately when the Contractor believes he has found evidence that could identify a potential responsible party. The

Contractor may move the drum out of the way of the general operations if he can do so without causing damage to the evidence. If there is a distinct possibility of loss of evidence during the drum relocation the Contractor will have to cease or move his operation in order to preserve the evidence.

- f. After the Contractor completes the staging, inventory, and sampling at each site they will be required to submit a copy of the master drum log to the State for review. The State will review the master drum log and respond to the Contractor on how to proceed with the compatibility testing. The samples will remain at the Contractor's laboratory until such time that the State responds to the Contractor on how to proceed with the compatibility testing. This is anticipated to take one (1) week.
- g. The State shall be given the opportunity to have split samples prepared by the Contractor for any and all samples, excluding gases, obtained under this contract. Not more than 25% of the samples will be split.

B. Sample Shipment

- 1. Unanalyzed samples shall be transported, in accordance with all applicable regulating requirements. If a material specifically identified in the Department of Transportation (DOT) Hazardous Material Table (49 CFR 172.101) is known to be contained in a sample at or above the reportable quantity (RQ), that sample shall be transported as prescribed therein.

C. Compatibility Testing

- 1. The testing and analytical procedures to be used on the drummed materials will be conducted in conformance with the Code of Federal Regulations, Methods for Chemical Analysis of Water and Waste, American Society of Testing and Materials, and Test Methods for Evaluating Solid Water.
- 2. Compatibility testing of wastes shall include, at a minimum, the tests listed below. All analysis must be performed in a CLP laboratory.
 - radiation Screening
 - pH
 - Water Reactivity
 - Oxidation/Reduction (Redox) Potential
 - Water/Hexane Solubility
 - Flammability
 - Specific Gravity

- Qualitative organic and inorganic spot tests including, but not limited to, cyanide, sulfide and organic peroxide
- Total petroleum hydrocarbons
- Actual bench scale compatibility blending
- PCB Screening and Analysis shall be conducted on all waste samples, including the samples from the composite blending outlined in Sampling, d, above. Additional composite samples can be obtained from the remaining waste samples so long as they fit the following criteria:
 - The samples are taken from drums at the same location
 - The samples are similar compatible wastes
 - Composition samples will not be made up from more than 10 individual sources. Should levels of PCB's be detected by Aroclor Chromatographic standard matching to 5 ppm or greater, the Contractor must then analyze each waste container individually to determine the source(s) of PCBs.

D. Disposal Analysis

1. After the Contractor completes the compatibility testing for a group of drums, he will submit a copy of the compatibility test results to the State for review. The State will require approximately one week to review the compatibility test results and provide direction to the Contractor as to how to proceed. The State will direct the Contractor as to which the following two alternatives to undertake:
 - a. Temporary storage of the drums on-site in the staging area until the State completes additional analyses and arranges for off-site disposal of the drums. The additional analyses and off-site disposal are not part of this work.
 - b. On-site disposal of the drums in the landfill, underneath areas to be capped at locations designated by the State.
2. If, following the Disposal Analysis, on-site disposal is the selected alternative by the State, the Contractor shall adhere to the following minimum requirements.
 - a. The Contractor shall provide adequate manpower and proper equipment for drum disposal, including water entering the excavations;
 - b. Staging and crushing for on-site placement of empty drums as designated by the State;

- c. Staging and placement of other drums as designed by the State.
- d. The Contractor's personnel and equipment will operate in a safe and efficient manner in accordance with the approved HASP.
- e. Drums shall be handled with a grappler equipped backhoe, front end loader, or forklift. Alternate methods of segregating or lifting drums may be used subject to prior approval from the State.
- f. All handling equipment shall be equipped with full frontal and side splash shields. Class ABC fire extinguishers shall be fitted to the body of each piece of equipment.

2.02 STAGING AREA

The Contractor shall provide drawings showing the location and design of his proposed drum staging and drum storage area prior to construction of this area. As a minimum, the staging and drum storage area shall include the following provisions. The staging and drum storage area shall be a minimum size of 10,000 square feet and be placed at a location approved by the Engineer and Construction Manager. The staging and drum storage area shall be contained by constructing berms to a minimum height of 1 foot, the base and sides of this area shall be covered with a minimum of three inches of uniform medium sand. A high density polyethylene liner with a minimum thickness of 40 mils as manufactured by Gundle or equal shall be placed over the sand bedding layer in accordance with manufacturer recommendations. The staging area shall be sloped to drain to lined sump which can be periodically drained by pumping upon visual inspection.

2.03 FILL MATERIAL

- A. All excavations made for the purpose of removing drums shall be backfilled with embankment material as described in Section 02222 or material excavated on-site as approved by the Engineer.

2.04 OVERPACK DRUMS

- A. Overpack drums shall conform to DOT 49 CFR 173.3 and shall be constructed of the same material as the drums to be overpacked.

PART 3 - INSTALLATION

3.01 GENERAL

- A. The Contractor shall perform all excavations to the lines, grades, and elevations specified. Due to the unknown nature of the area substrata and waste material, the Health and Safety Officer shall direct the rate and manner of excavation to insure safety of all on-site personnel.

3.02 PROCEDURES

A. Excavation of Subsurface Drums

1. Subsurface drums encountered during fill/refuse relocation and other construction operations will be removed. The Contractor shall take all necessary steps to remove the drums intact to preserve any evidence of ownership. Following inspection and testing of contents, the drums will be overpacked and staged at suitable locations on site. The State will then arrange for their removal and disposal under a change order or separate contract. All work shall be done in accordance with the approved SAWC Plan.

B. Dewatering

1. The Contractor shall construct temporary berms, swales, and other facilities required to prevent surface water from entering the area of excavation.
2. The Contractor shall provide and maintain proper and satisfactory means and devices for the removal of ground water which may enter the excavation.
3. Where the presence of fine grained subsurface materials and a high ground water table may cause upward flow of water into the excavation resulting in a "quick" or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction. The well point system shall be designed and installed in accordance with Section 02220 Earthwork.
4. The Contractor shall collect all surface and ground water accumulated during the excavation for disposal.

C. Backfill and Compaction

1. Subsequent to removal of drums and associated material from the area of excavation and subject to the approval of the Engineer, the Contractor shall backfill the excavation to grade with embankment material as described in Section 0222 or material excavated on site as approved by the Engineer.
2. Backfill shall be placed in lifts having a maximum depth of 12 inches or as approved by the Engineer.
3. Each lift shall be compacted to 95% of its maximum dry density as determined by ASTM D1557-78. Compaction shall be accomplished by means of a vibratory roller or other approved equipment.

D. In-Place Density

1. A minimum of one (1) in-place density test will be required for every 10,000 square feet of each lift.
2. If a portion of the backfilled area fails density criteria, it will be recompact to the areal limits defined by other tests meeting the criteria, and retested. In the event of subsequent failure, the entire area failing the second test will be removed and replaced at the Contractor's expense.
3. In-place density tests shall be conducted in accordance with ASTM D2922-81 and ASTM 3017-88.
4. All in-place density tests shall be submitted to the Engineer within two days following each test.

E. Drum Inventory

1. As subsurface drums are exposed and/or surface drums are encountered, each drum shall be subject to the following inventory procedure:
 - a. The location of each container shall be plotted on a reproducible copy of a topographic plan of the site.
 - b. An information sheet shall be developed upon which the Contractor shall record information such as container size, condition, type of materials, and any identifying characteristics of the container. The format of the information sheet shall be as approved by the Engineer, in the SAWC Plan.
 - c. Each inventoried item will be tagged with a numeric code corresponding to the information sheet prepared for that item.
 - d. Copies of the information sheets and location plan shall be provided to the Engineer.

F. Initial Staging

1. The Contractor shall establish a staging area on site. The staging area shall include drum processing area and a drum storage area. The drum processing area shall be surrounded by a containment berm.
2. The Contractor shall utilize a front end loader to transport inventoried drums to the drum processing portion of the staging area.

3. Prior to transport to the staging area, the Contractor shall either transfer the contents of the unsound drums to DOT approved containers or overpack the unsound drum.
4. Drummed liquids shall be transferred using hand-operated, non-sparking drum pumps. Any small containers (e.g. 5 gal. or less) shall be transferred by gently pouring the contents into drums using wide rim funnels.
5. If transferring the contents of unsound drums employing these methods is not feasible, a portable containment structure shall be placed immediately adjacent to the unsound drum. The unsound drum shall be placed in the containment structure where it will be maneuvered to a position where the contents can be transferred or the drum overpacked. Overpack drums shall be immediately available during the handling of any unsound contains. In the event of a drum rupture, the ruptured drum shall be overpacked immediately in an effort to minimize any release of contaminants.

G. Compatibility Testing

1. Unless otherwise directed in the field by the Engineer, the Contractor shall perform a series of compatibility tests during the staging activities to determine the compatibility testing of contaminated materials for compositing purposes. All field compatibly testing shall be performed in accordance with the approved SAWC plan.

H. Final Staging

1. Following compatibility testing and the characterization of each container, the Contractor shall, to the extent possible, composite the materials by transferring the compatible materials into common containers. In addition, materials which are improperly contained shall be transferred into the appropriate containers. Decontamination liquids shall be contained in drums, placed in the staging area, and characterized in accordance with the New Jersey Department of Environmental Protection Regulations.

- END OF SECTION -

SECTION 02289

SOIL BARRIER LAYER TEST SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. The Work covered by this Section shall include all labor, equipment and materials necessary to construct a test section of the contractors proposed soil barrier layer.

The purpose of the test section is to develop and demonstrate construction methods to produce a soil barrier layer satisfy the requirements of the specification in all respects. Of particular concern are the construction methods to be adopted to construct the barrier layer on the steeper side slopes and the achievement of a soil barrier layer permeability of 1.0×10^{-7} centimeters per second (cm/sec) or less.

B. Related Work Specified Elsewhere:

1. Soil Barrier Layer: Section 02290
2. Soil Barrier Layer with Bentonite: Section 02291

1.02 TESTING

- A. All soil testing services as specified herein necessary for the Contractor to obtain an approved material for use in the construction of the soil barrier layer shall be provided by the Contractor. All testing including laboratory and field services required during construction of the soil barrier layer shall be provided by the Contractor.
- B. An established grid with numbered spaces will be set up by the Contractor for purposes of selecting sampling points. The grid spaces shall be numbered consecutively, and sampling will be conducted based on randomly selecting numbers assigned to the grid spaces. Any suspect points shall also be sampled.

1.03 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

- A. American Society for Testing and Materials (ASTM)

ASTM D698-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb Rammer and 12-in Drop.
ASTM D1556-82	Density of Soil in Place by the Sand-Cone Method.
ASTM D1557-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer 18-in. Drop.
ASTM D1587-83	Thin-Walled Tube Sampling of Soils.
ASTM D2167-84	Density and Unit Weight of Soil In Place by the Rubber Balloon Method.
ASTM D2216-80	Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures, Laboratory
ASTM D2922-81	Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
ASTM D3017-88	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depths)

Office of the Chief of Engineers, Engineer Manual U.S. Army Corps of Engineers. EM 1110-2-1906 Laboratory Soils Testing, Appendix VII.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The materials for the test section shall consist of natural soils or soils amended with bentonite selected by the Contractor for use in the soil barrier layer.
- B. The soil barrier layer material will be free of hazardous materials in accordance with the Special Provisions.

The Contractor should exercise reasonable care to avoid using contaminated materials. Routine analyses is not necessarily required but the State reserves the right to test suspect materials at the State's expense and reject them if the material exceeds the limits. The rejected materials shall be removed from the site even if they have been incorporated into the work.

- C. The soil barrier layer material shall be obtained from a source subject to the approval of the Engineer.
- D. Prior to approval of the test section source material, the soil material must be tested to determine the appropriate range of moisture-density relationships to obtain the specified permeability. The tests shall be run prior to construction of

the test section at any time during the contract with the Engineer requests further testing to insure that the characteristics of the soil barrier layer material obtained from the borrow area(s) have not changed.

- five compaction points based on ASTM 698-78 with moisture contents within the approximate range of 3% of optimum to 6% wet of optimum;
- five compaction points based on ASTM 1557-78 with moisture contents within the approximate range of 3% dry of optimum to 6% wet of optimum;
- ten permeability tests (based on U.S. Army Corps of Engineers Manual EM-110-2-1906, Appendix VII) on remolded samples corresponding to water contents and densities used to develop the standard and modified compaction curves.

The Contractor shall select the sample locations using a random number process with a determined grid so that the selected sample containers are representative samples of the borrow source. The method used by the Contractor to determine the sample locations shall be presented to the Engineer.

The standard and modified compaction curves will be superimposed on each other and the hydraulic conductivity for each data point noted. From this composite curve the acceptable range of density and moisture content shall be identified and will be used as control in the field during construction of the test sections.

- E. The Contractor must submit testing methods (prior to conducting test), test results, and a certification from the approved soils laboratory that the soil barrier layer material meets requirements specified herein. The results of all testing specified herein shall be submitted to the Engineer for approval.

PART 3 EXECUTION

3.01 CONSTRUCTION OF TEST SECTION

- A. Construction of the soil barrier layer test section shall be performed in an area overlying the regraded refuse and shall incorporate the same soil materials, equipment, and procedures proposed for the full cap system. The demonstration area shall be a minimum of four times wider than the widest piece of construction equipment proposed. The demonstration area shall be long enough to allow equipment to achieve normal operating speed over a minimum 25 foot length and shall be constructed on a surface having a slope equal to the maximum slope required for the full cap system. The Engineer shall approve or designate the location for the test section. Full scale cover soil placement shall not commence until the placement method is accepted by the Engineer.

- B. The Engineer will inspect each lift, and placement of subsequent lifts may not commence until the previous layer is accepted by Engineer.
- C. The soil barrier layer test section shall be constructed prior to installation of the soil barrier layer on the graded refuse and shall be tested in accordance with the following standards and frequencies.

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Moisture Content	20% by ASTM D2216-80 and 80% by ASTM D3017-88	4 tests/lift of soil placed	Optimum to 6% wet of optimum
In-Place Density	ASTM D1556-82 or ASTM D2922-81 or ASTM D2167-84	4 tests/lift of soil placed	95% of maximum dry density attained by ASTM D689-78 Method D with 15 blow/layer modification
Undisturbed Shelby Tube Sample	ASTM D1587-83	4 lift of soil placed	3 inch diameter minimum
Permeability**	EM 1110-201906	4 lift of soil placed	Maximum permeability of 1×10^{-7} cm/sec

- D. Test section quality assurance/quality control testing shall be compared to testing values used to generate the composite curve of moisture/density values required in 2.01 (d) for determination of pass/fail status. The test section shall be re-worked and re-tested as specified or directed by the Engineer until passing results are achieved.
- E. At four locations in the test section, as directed by the Engineer, an inspection pit shall be excavated to verify the consistency of the compacted materials and that the intent of the specifications are being satisfied. The pit shall be at least 2 ft. by 4 ft. and excavated to a depth to expose the contact with the layer below. The edges of the test pit shall be excavated by hand to eliminate effect of backhoe bucket smearing the sides.
- F. At the discretion of the Engineer, the test section may be incorporated as part of the landfill permanent final cover.
- G. Access ramps shall be constructed to ensure even distribution of construction traffic on the test section. After completion of the test section, the access ramps shall be removed.

- H. If in the opinion of the Engineer the construction methods, equipment or materials result in unsatisfactory final cover placement, Contractor shall make necessary modifications and reconstruct the appropriate sections or layer of the test section.
- I. Placement of the permanent final cover shall not start until the test fill and all associated testing has been completed and accepted by the Engineer in writing.
- J. The level of effort necessary to achieve passing results for the soil barrier layer shall be documented and approved by the Engineer. The Contractor will then be required to adhere to the level of effort throughout the project.

- END OF SECTION -

SECTION 02290
SOIL BARRIER LAYER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation, backfilling, and compacting including the loosening, removing, working, transporting, storage, fill, and disposal of all materials necessary for construction of the soil barrier layer (shall have a permeability less than 1.0×10^{-7} cm/sec), as shown or specified or as directed by the Engineer.

B. Related Work Specified Elsewhere:

1. Clearing: Section 02110
2. Earthwork: Section 02220
3. Embankment: Section 02222
4. Fill/Refuse Relocation: Section 02229
5. Soil Barrier Layer Test Section: Section 02289
6. Flexible Membrane Cover: Section 02294
7. Geotextile Used as Filter Fabrics: Section 02296

1.02 TESTING

1. All soil testing services as specified herein necessary for the Contractor to obtain an approved cover material for use in the construction of the soil barrier layer shall be provided by the Contractor. All testing including laboratory and field services required during construction of the soil barrier layer shall be provided by the Contractor.
2. An established grid with numbered spaces will be set up by the Contractor for purposes of selecting sampling points. The grid spaces shall be numbered consecutively and sampling will be conducted based on randomly selecting numbers assigned to the grid spaces. Any suspect points shall also be sampled.

1.03 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. 40 CFR Part 262

B. American Society for Testing and materials (ASTM)

ASTM D75-87 Sampling Aggregates

ASTM D420-87	Practice for Investigation and Sampling Soil and Rock for Engineering Purposes.
ASTM D422-63	Method for Particle-Size Analysis of Soils
ASTM D698-78	Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb Rammer and 12-in. Drop
ASTM D1556-82	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557-78	Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-in. Drop
ASTM D1587-83	Method for Thin Walled Tube Sampling of Soils
ASTM D2487-85	Test Method for Classification of Soils for Engineering Purposes
ASTM D2167-84	Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method
ASTM D2216-80	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
ASTM D2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017-88	Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C. OFFICE OF THE CHIEF OF ENGINEERS, ENGINEER MANUAL, U.S. Army Corps of Engineers EM 1110-2-1906 Laboratory Soils Testing, Appendix VII.

D. New Jersey draft guidance documents on soil action levels:

- . Basis for NJDEP Soil Action Levels, February 1990.
- . Analytical Procedures, Evaluation and Remediation Guidance for Petroleum Hydrocarbon Residues in Soil, April 1990.

E. NJAC 7:26-8.1

1.04 SUBMITTALS

- A. Source of borrow material for soil barrier layer.
- B. The source material must be tested to determine the appropriate range of moisture - density relationships to obtain the specified permeability prior to being utilized on-site.
- C. Location of samples collected within borrow areas for laboratory testing.
- D. Proposed soil testing laboratory.
- E. Laboratory testing methods to be used.

- F. Results of laboratory testing.
- G. Laboratory certification of soil barrier layer material.
- H. Results of Field Tests.
- I. Required surface disturbance permits.

PART 2 - PRODUCTS

2.01 SOIL BARRIER LAYER

A. Suitable Material

1. The soil barrier layer material under this specification shall be characterized as a natural clay material with a minimum of 30% of the particle sizes finer than a number 200 sieve. The material shall be free of debris, roots, organic or frozen materials having a maximum dimension of 2 inches. In addition, the material shall provide a compacted in-place hydraulic conductivity equal to or less than 1×10^{-7} cm/sec.
2. Unsuitable materials include all ASTM D 2487 soil classifications not listed as suitable, or suitable materials that contain debris, roots, organic or frozen materials, hazardous material as defined by 40 CFR Part 262.11 or by NJAC 7:26-8.1, whichever is more stringent; stones having a maximum dimension larger than 2 inches, or not meeting the permeability requirement. Otherwise, suitable material which is unsuitable due to excess moisture content will be classified as unsuitable material unless it can be dried by manipulation, aeration, or blending with other materials satisfactorily as determined by the Engineer.

- B. The soil barrier layer material will be free of hazardous materials in accordance with the Special Provisions.

The Contractor should exercise reasonable care to avoid using contaminated materials. Routine analyses is not necessarily required but the State reserves the right to test suspect materials at the State's expense and reject them if the material exceeds the limits. The rejected materials shall be removed from the site even if they have been incorporated into the work.

- C. The soil barrier layer material shall be obtained from a source subject to the approval of the Engineer.
- D. Prior to bringing the source material on-site, the soil material must be tested to determine the appropriate range of moisture-density relationships to obtain the specified permeability. The tests shall be run for every 50,000 cy of borrow source, and at any time during the contract the Engineer request further

testing to insure that the characteristics of the soil barrier layer material obtained from the borrow area(s) have not changed.

- five compaction points based on ASTM 698-78 with moisture contents within the approximate range of 3% dry of optimum to 6% wet of optimum;
- five compaction points based on ASTM 1557-78 with moisture contents within the approximate range of 3% dry of optimum to 6% wet of optimum;
- ten permeability tests (based on U.S. Army Corps of Engineers Manual EM-110-2-1906, Appendix VII) on remolded samples corresponding to water contents and densities used to develop the standard and modified compaction curves.

The Contractor shall select the sample locations using a random number process with a determined grid so that the selected sample locations are representative samples of the borrow source. The method used by the Contractor to determine the sample locations shall be presented to the Engineer.

The standard and modified compaction curves will be superimposed on each other and the hydraulic conductivity for each data point noted. From this composite curve the acceptable range of density and moisture content shall be identified and will be used as control in the field during construction of the test pads.

- E. The Contractor must submit testing methods (prior to conducting tests), test results, and a certification from the approved soils laboratory that the soil barrier layer material meets requirements specified herein. The results of all testing specified herein shall be submitted to the Engineer for approval.
- F. Samples of soil to be used in the construction of the soil barrier layer shall be taken in accordance with ASTM D420-87. Stockpiles shall be sampled in accordance with ASTM D75-87.
- G. During the construction of the soil barrier layer, material from the borrow source shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle-Size Analysis	ASTM D422-63	Once per 1,000 cy	NA
Liquid Limit	ASTM D4318-84	Once per 1,000 cy	NA
Plastic Limit	ASTM D4318-84	Once per 1,000 cy	NA
Plasticity Index	ASTM D4318-84	Once per 1,000 cy	NA

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Moisture Content	ASTM D2216-80	Once per 1,000 cy	NA
Soil Moisture Density Relationship	ASTM D698-78 Method D (15 blow/layer modification)	Once per 5,000 cy or when material changes are noted	NA
Permeability**	EM 1110-2-1906	Once per 5,000 cy or when material changes are noted	Maximum 1.0×10^{-7} cm/sec

NA indicates Not Applicable.

** Samples to be tested for permeability will be compacted to 95% of the maximum dry density determined by ASTM D698-78 with the 15 blow/layer modification. The consolidation pressure applied to the sample during testing shall simulate the effective stress anticipated at the mid-depth of the cap system.

H. Following installation of each lift of the soil barrier layer, each lift of the soil barrier layer shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Moisture Content	20% by ASTM D2216-80 and 80% by ASTM D3017-88	5 tests per acre per lift of soil placed	Optimum to 6% wet of optimum moisture
In-Place Density*	ASTM D1556-82 or ASTM D2922-81 or ASTM D2167-84	5 tests per acre per lift of soil placed	95% of maximum dry density attained by ASTM D698-78 Method D with 15 blow/layer modification utilizing compactor curves determined under 2.01 G above
Undisturbed Shelby Tube Sample	ASTM D1587-83	3 test per acre per lift of soil placed	3 inch diameter minimum
Permeability**	EM 1110-2-1906	3 test per acre per lift of soil placed	Maximum permeability of 1×10^{-7} cm/sec

* Testing performed using ASTM D2922-81 shall be duplicated at a rate of 10% utilizing either ASTM D1556-82 or ASTM D2167-84 adjacent to the testing performed by ASTM D2922-81. The

Contractor shall provide an explanation between the differences in duplicate testing.

- ** Permeability testing shall be performed on undisturbed Shelby Tube samples. The consolidation pressure applied to the sample during testing shall simulate the effective stress anticipated at the mid-depth of the cap system.
- I. Tests resulting in penetration of the soil barrier layer shall be repaired using bentonite.
- J. If at any time during the contract the Engineer requests further testing to insure that the characteristics of the soil barrier layer material obtained from the borrow area(s) have not changed, the Contractor shall perform these tests at no cost to the State.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. The entire surface to be covered with soil barrier layer shall be cleared, stripped, and grubbed of all trees, shrubs, stumps, etc... in accordance with the Section 02110: Clearing, before any soil barrier layer material is placed. Following clearing and grubbing required fill/refuse relocation shall be conducted in accordance with Section 02229. The surface shall be brought to the required subgrade utilizing embankment material in accordance with Section 02222.
- B. The entire surface to be covered with soil barrier layer shall be prepared, tested, by the Contractor and accepted by the Engineer in accordance with Sections 02220 and 02222 prior to placement of the soil barrier layer.
- C. Prior to installation of the soil barrier layer, the Contractor shall establish a seventy-five foot grid over the site and take elevations at each grid point. The Contractor shall take elevations at each grid location upon completion of each soil barrier layer lift (or as directed by the Engineer) to measure the thickness of the lifts and to substantiate that soil barrier layer installation is proceeding in accordance with the specifications and drawings. The elevation data shall be transmitted to the Contract Manager/Engineer in hard copy or diskette and approved prior to the installation of the next layer.

3.02 INSTALLATION

- A. General
 - 1. Any settlement that occurs in the covered area shall be refilled utilizing soil barrier layer material and compacted as directed by the Engineer.

B. Procedures

1. Placement of the soil barrier layer material shall be in accordance with the provisions of this Section. Any soil barrier layer materials which cannot comply with provision of this Section will be considered as spoil and will be removed and disposed of at the Contractor's expense.
2. The water content of the soil barrier layer shall be controlled during placement within the range necessary to obtain compaction specified and to prevent the formation of cracks during rolling. The placement water content shall be maintained within optimum moisture and 6% wet of optimum water content for compaction as determined by tests performed as per paragraph 2.01D of this section. The Contractor shall perform all necessary work to adjust the placement water content within this range in order to achieve a maximum permeability of 1.0×10^{-7} cm/sec.
3. The soil barrier layer material shall not be applied when the atmospheric temperature is less than 40 degrees fahrenheit. If the temperature falls below 35 degrees fahrenheit, completed soil barrier layer areas shall be protected against any detrimental effects of freezing.
4. The required maximum lift thickness will be specified as eight inches for all lifts. Material shall not be placed in lifts greater than eight inches unless a greater thickness is allowed by the Engineer upon satisfactory demonstration by the Contractor that the materials and compaction efforts are adequate to obtain the required permeability and density.
5. Material shall be placed in uniform lifts and thoroughly compacted to the specified density using sheepsfoot or wobble-wheeled rubber tire rollers. The compaction method shall be that developed and demonstrated during construction of the soil barrier layer test section. A minimum of two compaction coverages is required for each lift. Each lift shall be tested for proper compaction and permeability before successive lifts are applied.
6. Clay balls or lumps present in material used in installation of the soil barrier layers shall not exceed 4 inches in the maximum dimension unless approved by the Engineer.
7. If a portion of the soil barrier layer fails any of the density or permeability criteria, it will be recompacted to the areal limits defined by other tests meeting the criteria, and retested. In the event of subsequent failure, the entire area failing the second test will be removed and replaced at the Contractor's expense.

8. If, due to rain or other causes, the material exceeds the range of allowable moisture content for satisfactory compaction, it shall be allowed to dry, assisted by discing or harrowing, if necessary, before compaction or filling is resumed.
9. If, due to desiccation or other causes, the material cracks, the cracked area must be removed and replaced. The cracked area may not be repaired solely by re-rolling.
10. To maintain an adequate bond between lifts, the Contractor shall maintain the soil barrier layer material surface within the moisture control limits. If overly smooth, in the opinion of the Engineer, the Contractor shall work the surface with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide a satisfactory bond before the next succeeding lift is placed.
11. If the compacted surface of any soil barrier layer surface is too wet for proper compaction of the succeeding layer, the Contractor shall remove the layer; allow it to dry; or work the material with suitable equipment to reduce the moisture content to the allowable range. The layer must then be recompact and retested before placement of a successive lift.
12. Where layers of the soil barrier layer surface are to be placed against a sloping surface or natural soil or previously placed cap, the Contractor shall bench the existing surface so that the new cap layers overlay the existing material for a 24-inch horizontal distance.
13. The Contractor shall be required to seal the working surface of the soil barrier layer surface from surface water infiltration at the end of the day, or when rain is expected. Sealing shall be accomplished by rolling the soil barrier layer surface with a smooth drum roller. The soil barrier layer surface shall always be placed in such a manner that a slight crown or slope is maintained on the cap surface to prevent ponding or runoff. Prior to placement of succeeding lifts, the surface shall be roughened utilizing the approved compaction equipment (sheepsfoot or wobble-wheeled roller).
14. Stockpiling of material on the completed soil barrier layer, or any portion of the completed cover shall not be allowed without the written permission of the Engineer. Damage caused by stockpiling of material shall be repaired by the Contractor at no additional cost to the State.
15. Compaction or consolidation achieved by traveling trucks, machines, and other equipment will not be accepted unless such procedures are approved by the Engineer and proper compaction and permeability criteria are achieved.

16. Any damage to the completed surface of the soil barrier layer, whether caused by settling, erosion, desiccation, the Contractor's work, or any other occurrences, shall be immediately repaired and retested at the Engineers option and maintained in good condition until completion of the work.

- END OF SECTION -

SECTION 02291

SOIL BARRIER LAYER WITH BENTONITE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation, backfilling, and compacting including the loosening, removing, working, transporting, storage, fill, and disposal of all materials necessary for construction of the soil-bentonite barrier layer (shall have a permeability less than 1.0×10^{-7} cm/sec, as shown or specified or as directed by the Engineer.

B. Related Work Specified Elsewhere:

1. Clearing: Section 02110
2. Earthwork: Section 02220
3. Embankment: Section 02222
4. Fill/Refuse Relocation: Section 02229
5. Soil Barrier Layer Test Section: Section 02289
6. Flexible Membrane Cover: Section 02294
7. Geotextiles Used as Filter Fabrics: Section 02296

1.02 TESTING

1. All soil testing services as specified herein necessary for the Contractor to obtain an approved cover material for use in the construction of the soil-bentonite barrier layer shall be provided by the Contractor. All testing including laboratory and field services required during construction of the soil-bentonite barrier layer shall be provided by the Contractor.
2. An established grid with numbered spaces will be set up by the Contractor for purposes of selecting sampling points. The grid spaces shall be numbered consecutively and sampling will be conducted based on randomly selecting numbers assigned to the grid spaces. Any suspect points shall also be sampled.

1.03 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. 40 CFR 262

B. New Jersey Administrative Code (NJAC) 7:26-8.1

C. American Society for Testing and Materials (ASTM)

ASTM C50-86	Methods for Sampling, Inspection, Packing, and Marking of Lime and Limestone Products.
ASTM D75-87	Sampling Aggregates
ASTM D420-87	Practice for Investigation and Sampling Soil and Rock for Engineering Purposes
ASTM D422-63	Method for Particle-Size Analysis of Soils
ASTM D698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb Rammer and 12-in. Drop
ASTM D1556-82	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557-78	Method for Moisture-Density Relations of Soils and Soil-Aggregate
ASTM D1587-83	Method for Thin Walled Tube Sampling of Soils
ASTM D2487-85	Test Method for Classification of Soils for Engineering Purposes
ASTM D2167-84	Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method
ASTM D2216-80	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
ASTM D2922-81	Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017-88	Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C. OFFICE OF THE CHIEF OF ENGINEERS, ENGINEER MANUAL, U.S. Army Corps of Engineers EM 1110-2-1906 Laboratory Soils Testing, Appendix VII.

1.04 SUBMITTALS

- A. Source of borrow material for soil barrier layer.
- B. The source material must be tested to determine the appropriate range of moisture - density relationships to obtain the specified permeability, prior to being utilized on-site.
- C. Location of samples collected within borrow areas for laboratory testing.
- D. Proposed soil testing laboratory.
- E. Laboratory testing methods to be used.
- F. Results of laboratory testing.
- G. Laboratory certification of soil-bentonite barrier layer material.

- H. Manufacturer's certification for bentonite material.
- I. Results of Field Test.
- J. Required surface disturbance permits.

PART 2 - PRODUCTS

2.01 SOIL BARRIER LAYER

- A. The soil to be utilized for construction of the soil bentonite barrier layer shall be natural soil meeting the requirements of this Section, that when mixed with the proper portion of bentonite is capable of achieving the required permeability of 1.0×10^{-7} cm/sec or less.

The soil to be used in construction of the soil-bentonite barrier layer shall be free of lenses, rubbish, debris, roots, organic or frozen materials. Suitable material shall be free of cobbles, stones, rocks and fractured stone having a maximum dimension of 2 inches or greater.

Unsuitable materials include suitable materials that contain debris, roots, organic or frozen materials, hazardous material as defined by 40 CFR Part 262.11 or by NJAC 7:26-8.1, whichever is more stringent; or stones having a maximum dimension larger than 2 inches. Otherwise suitable material which is unsuitable due to excess moisture content will be classified as unsuitable material unless it can be dried by manipulation, aeration, or blending with other materials

- B. The soil to be used in the construction of the soil-bentonite barrier layer shall be free of hazardous materials in accordance with the Special Provisions.

The Contractor should exercise reasonable care to avoid using contaminated materials. Routine analyses is not necessarily required but the State reserves the right to test suspect materials at the State's expense and reject them if the material exceeds the limits. The rejected materials shall be removed from the site even if they have been incorporated into the work.

- C. The soil-bentonite barrier layer material shall be obtained from sources subject to the approval of the Engineer.
- D. Prior to placement of the source material, the soil-bentonite material must be tested to determine the appropriate range of moisture-density relationships to obtain the specified permeability. The tests shall be run for every 50,000 cy of borrow source, and at any time during the contract the Engineer request further testing to insure that the characteristics of the soil barrier-bentonite layer material obtained from the borrow area(s) have not changed.

- five compaction points based on ASTM 698-78 with moisture contents within the approximate range of 3% dry of optimum to 6% wet of optimum;
- five compaction points based on ASTM 1557-78 with moisture contents within the approximate range of 3% dry of optimum to 6% wet of optimum;
- ten permeability tests (based on U.S. Army Corps of Engineers Manual 1110-2-1906 Appendix VII) on remolded samples corresponding to water contents and densities used to develop the standard and modified compaction curves.

The above testing will be conducted utilizing the approved rate of bentonite as determined during laboratory testing and construction of the soil barrier layer test section.

The Contractor shall select the sample locations using a random number process with a determined grid so that the selected sample locations are representative samples of the borrow source. The method used by the Contractor to determine the sample locations shall be presented to the Engineer for approval.

The standard and modified compaction curves will be superimposed on each other and the hydraulic conductivity for each data point noted. From this composite curve the acceptable range of density and moisture content shall be identified and will be used as control in the field during construction of the test pads.

- E. The Contractor must submit testing methods (prior to conducting tests), test results, and a certification from the approved soils laboratory that the soil-bentonite barrier layer material meets requirements specified herein. The results of all testing specified herein shall be submitted to the Engineer for approval.
- F. Prior to mixture of the soil with bentonite, soil from the borrow source shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle-Size Analysis	ASTM D422-63	Once per 1,000 cy	NA
Liquid Limit	ASTM D4318-84	Once per 1,000 cy	NA
Plastic Limit	ASTM D4318-84	Once per 1,000 cy	NA
Plasticity Index	ASTM D4318-84	Once per 1,000 cy	NA
Moisture Content	ASTM D2216-80	Once per 1,000 cy	NA

NA indicates Not Applicable.

2.02 BENTONITE

- A. Bentonite to be used in construction of the soil-bentonite barrier layer shall either be an untreated bentonite, a treated bentonite, or polymer bentonite with a free flowing, high swelling Wyoming type sodium bentonite base and be obtained from a source approved by the Engineer.
- B. The Contractor shall submit the manufacturer's literature describing the gradation, swell potential, colloid content, layer permeability, and cation exchange capacity of the bentonite for approval by the Engineer prior to conducting testing of the bentonite.
- C. The Contractor shall submit testing methods prior to conducting tests. The results of all soil testing specified herein shall be submitted to the Engineer for approval.
- D. Bentonite, either bagged or bulked, to be used in construction of the soil-bentonite barrier layer shall be sampled in accordance with ASTM C50-86 and tested in accordance with the following standards and frequencies unless otherwise approved by the Engineer.

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>
Particle Size	ASTM D422-63	Once Per 50 tons

2.03 WATER

- A. Water added to the soil-bentonite mixture shall be approved by the Engineer.
- B. Water added to the soil-bentonite mixture shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the soil-bentonite mixture.

2.04 SOIL-BENTONITE MATERIAL

- A. Soil and bentonite to be used in construction of the soil-bentonite layer shall be approved by the Engineer.
- B. Prior to construction of the test pad, the soil barrier layer material shall have a remolded permeability of a maximum of 1.0×10^{-7} cm/sec as identified by laboratory permeability tests. A minimum of three (3) such permeability tests shall be performed on the proposed soil-bentonite material mixture utilizing actual materials of construction. Compaction of the material shall be to 95% of the dry density determined attained by ASTM D698-78 Method D with 15 blow/layer modification. Results of the permeability test and the combination of materials (% of materials) used in the mixture shall be submitted to the Engineer for approval prior to construction of the test pad.

- C. During placement each combination of bentonite and soil shall be tested in accordance with the following standards and frequencies.

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle-Size Analysis	ASTM D422-63	Once per 1,000 cy	NA
Moisture Content	ASTM D2216-80	Once per 1,000 cy	NA
Soil Moisture *	ASTM D698-78	Once per 1,000 cy	NA
Density Relationship	Method D (15 blow/layer modification)	Once per 5,000 cy or when material changes are noted	NA
Permeability **	EM 1110-2-1906	Once per 5,000 cy or when material changes are noted	Maximum 1.0×10^{-7} cm/sec

NA indicates Not Applicable.

- ** Samples to be tested for permeability will be compacted to 95% of the maximum dry density determined by ASTM D698-78 with the 15 blow/layer modification. The consolidation pressure applied to the sample during testing shall simulate the effective stress anticipated at the mid-depth of the cap system.

- D. Results of test for rate of bentonite application and permeability tests, as specified above shall be submitted to the Engineer. Once proposed mix has been accepted by the Engineer, it must be utilized.

- E. The following quality control testing shall be performed at the central mixing plant to ensure uniformity of the soil bentonite mixture:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>
Particle Size Analysis	ASTM D422-63	Once per 300 cy
Percent Bentonite in Soil Bentonite Mixture	Per Bentonite Suppliers recommendation	Once per 300 cy

- F. Following installation of each lift of the soil-bentonite barrier layer, each lift of the soil-bentonite barrier layer shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Moisture Content	20% by ASTM D2216-80 and 80% by ASTM D3017-88	5 tests per acre per lift of soil placed	Optimum to 6% wet of optimum moisture

In-Place Density	ASTM D1556-82 or ASTM D2922-81 or ASTM D2167-84	5 tests per acre per lift of soil placed	95% of maximum dry density attained by ASTM D698-78 Method D with 15 blow/ layer modification utilizing compaction curves determined under 2.04 C above
Undisturbed Shelby Tube Sample	ASTM D1587-83	3 test per acre per lift of soil placed	3 inch diameter minimum
Permeability**	EM 1110-2-1906	3 test per acre per lift of soil placed	Maximum permeability of 1×10^{-7} cm/sec

* Testing performed using ASTM D29922-81 shall be duplicated at a rate of 10% utilizing either ASTM D1556-82. The Contractor shall provide an explanation between the differences in duplicate testing.

** The consolidation pressure applied to the sample during testing shall simulate the effective stress anticipated at the mid-depth of the cap system.

G. Tests resulting in penetration of the soil-bentonite barrier layer shall be repaired using bentonite.

H. If at any time during the contract the Engineer requests further testing to insure that the characteristics of the soil-bentonite barrier layer material obtained from the borrow area(s) have not changed, the Contractor shall perform these tests at no cost to the State.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. The entire surface to be covered with soil-bentonite barrier layer shall be cleared, stripped, and grubbed of all trees, shrubs, stumps, etc... in accordance with the Section 02110: Clearing before any soil-bentonite barrier layer material is placed. Following clearing and grubbing, required fill/refuse relocation shall be conducted in accordance with Section 02229. The surface shall be brought to the required subgrade utilizing embankment material in accordance with Section 02222.

B. The entire surface to be covered with soil barrier layer shall be prepared, tested, by the Contractor and accepted by the Engineer in accordance with Sections 02220 and 02222.

C. Prior to installation of the soil-bentonite barrier layer, the Contractor shall establish a seventy-five foot grid over the site and take elevations at each grid point. The Contractor

shall take elevations at each grid location upon completion of each soil- bentonite barrier layer lift (or as directed by the Engineer) to substantiate that soil barrier layer installation is proceeding in accordance with the specifications and drawings. The elevation data shall be transmitted to the Contract Manager/Engineer in hard copy or diskette and approved prior to the installation of the next layer.

3.02 SOIL-BENTONITE MIXING PLANT

- A. The soil-bentonite mixing plant shall include the means for accurately proportioning the materials, as determined by the laboratory analysis and as approved by the Engineer as a result of construction of the soil-bentonite barrier layer test section, either by weighing or by volumetric measurement in order that the mixture shall meet the required design hydraulic conductivity.
- B. The plant shall be capable of producing a uniform soil-bentonite mixture within permissible variation from the mix formula and should include a continuous mixer of twin pug mill type. Accurate proportioning and thorough mixing of soil and bentonite will be required and must be obtained.

3.03 INSTALLATION

A. General

- 1. Any settlement that occurs in the covered area shall be refilled utilizing the accepted soil-bentonite barrier layer material and compacted as directed by the Engineer.

B. Procedures

- 1. Placement of the soil-bentonite barrier layer material shall be in accordance with the provisions of this Section. Any soil barrier layer materials which cannot comply with provision of this Section will be considered as spoil and will be removed and disposed of at the Contractor's expense.
- 2. The soil-bentonite mixture shall not be applied when the atmospheric temperature is less than 40 degrees Fahrenheit. No bentonite shall be mixed with soils that are frozen or contain frost. If the temperature falls below 35 degrees Fahrenheit, completed soil-bentonite barrier layer areas shall be protected against any detrimental effects of freezing.
- 3. The water content of the soil-bentonite layer shall be controlled during placement within the range necessary to obtain compaction specified and to prevent the formation of cracks during rolling. The placement water content shall be maintained within optimum moisture and 6% wet of optimum water content for compaction as determined by tests

performed as per paragraph 2.01D of this Section. The Contractor shall perform all necessary work to adjust the placement water content within this range in order to achieve a maximum permeability of 1×10^{-7} cm/sec.

4. The required maximum lift thickness will be specified as eight inches for all lifts. Material shall not be placed in lifts greater than eight inches unless a greater thickness is allowed by the Engineer upon satisfactory demonstration by the Contractor that the materials and compaction efforts are adequate to obtain the required permeability and density.
5. Material shall be placed in uniform lifts and thoroughly compacted to the specified density using sheepsfoot or wobble-wheeled rubber tire rollers. The compaction method must be that developed and demonstrated during construction of the soil barrier layer test section. A minimum of two compaction coverages is required for each lift. Each lift shall be tested for proper compaction and permeability before successive lifts are applied.
6. Soil balls or lumps present in material used in installation of the soil-bentonite barrier layers shall not exceed 4 inches in the maximum dimension unless approved by the Engineer.
7. If a portion of the soil-bentonite barrier layer fails any of the density or permeability criteria, it will be recompact to the areal limits defined by other tests meeting the criteria, and retested. In the event of subsequent failure, the entire area failing the second test will be removed and replaced at the Contractor's expense.
8. If, due to rain or other causes, the material exceeds the range of allowable moisture content for satisfactory compaction, it shall be allowed to dry, assisted by discing or harrowing, if necessary, before compaction or filling is resumed.
9. If, due to desiccation or other causes, the material cracks, the cracked area must be removed and replaced. The cracked area may not be repaired solely by re-rolling.
10. To maintain an adequate bond between lifts, the Contractor shall maintain the soil-bentonite barrier layer material surface within the moisture control limits. If overly smooth, in the opinion of the Engineer, the Contractor shall work the surface with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide a satisfactory bond before the next succeeding lift is placed.
11. If the compacted surface of any soil-bentonite barrier layer surface is too wet for proper compaction of the

succeeding layer, the Contractor shall remove the layer; allow it to dry; or work the material with suitable equipment to reduce the moisture content to the allowable range. The layer must then be recompact and retested before placement of a successive lift.

12. Where layers of the soil-bentonite barrier layer surface are to be placed against a sloping surface or natural soil or previously placed cap, the Contractor shall bench the existing surface so that the new cap layers overlay the existing material for a 24-inch horizontal distance.
13. The Contractor shall be required to seal the working surface of the soil-bentonite barrier layer surface from surface water infiltration at the end of the day, or when rain is expected. Sealing shall be accomplished by rolling the soil-bentonite barrier layer surface with a smooth drum roller. The soil barrier- bentonite layer surface shall always be placed in such a manner that a slight crown or slope is maintained on the cap surface to prevent ponding of runoff. Prior to placement of succeeding lifts, shall be roughened utilizing the approved compaction equipment (sheepsfoot or wobble-wheeled roller).
14. Stockpiling of material on the completed soil-bentonite barrier layer, or any portion of the completed cover shall not be allowed without the written permission of the Engineer. Damage caused by stockpiling of material shall be repaired by the Contractor at no additional cost to the State.
15. Compaction or consolidation achieved by traveling trucks, machines, and other equipment will not be accepted unless such procedures are approved by the Engineer and proper compaction and permeability criteria are achieved.
16. Any damage to the completed surface of the soil-bentonite barrier layer, whether caused by settling, erosion, desiccation, the Contractor's work, or any other occurrences, shall be immediately repaired and maintained in good condition until completion of the work.

- END OF SECTION -

SECTION 02292
DRAINAGE LAYER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation, backfilling, and compacting including the loosening, removing, working, transporting, storage, fill, and disposal of all materials necessary for construction of the drainage layer, as shown or specified or as directed by the Engineer.

B. Related Work Specified Elsewhere:

1. Geotextiles Used as Filter Fabrics: Section 02296
2. Pipeline Installation: Section 02600
3. Solid Polyvinyl Chloride Non-Pressure Pipe: Section 02620
4. Perforated Polyvinyl Chloride Drainage Pipe: Section 02621
5. Flexible Membrane Cover: Section 02294

1.02 TESTING

- A. All soil testing services as specified herein necessary for the Contractor to obtain an approved drainage layer material shall be provided by the Contractor. All testing including laboratory and field services required during construction of the drainage layer shall be provided by the Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM)

ASTM D422-63	Method for Particle Size Analysis of Soil
ASTM D2434-68	Test Method for Permeability of Granular Soils (Constant Head)

1.04 SUBMITTALS

- A. Source of borrow materials for drainage layer.
- B. Location of samples collected within borrow areas for laboratory testing.
- C. Proposed soil testing laboratory.
- D. Laboratory testing methods to be used.
- E. Results of laboratory testing methods.

- F. Laboratory certification of drainage layer material.
- G. Results of field tests.
- H. Required surface disturbance permits.

PART 2 - PRODUCTS

2.01 DRAINAGE LAYER MATERIAL

- A. Drainage layer material shall be obtained from a source approved by the Engineer.
- B. The drainage layer material shall be characterized as a granular material with a minimum permeability of 1×10^{-2} cm/sec as determined by laboratory testing performed in accordance with ASTM D2434-68. The sample shall be prepared by simulating field compaction and conditions. The drainage layer material shall have 100 percent passing the 3/8 inch sieve by weight and less than 5 percent passing the number 200 sieve based on analyses performed in accordance with ASTM D422-63.
- C. The drainage layer material must be uniform in composition and texture, clean and free from stones, organics, weeds, stumps, roots, toxic substances, and debris or similar substances. The drainage layer material will be free of hazardous materials in accordance with the Special Provisions.
- D. The Contractor shall submit testing methods (prior to conducting tests), test results, and a certification from the approved soils testing laboratory that the drainage layer material meets the requirements of this section. The results of all soils testing specified herein shall be submitted to the Engineer for approval.
- E. During installation of the drainage layer, material from the borrow source shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle-Size Analysis	ASTM D422-63	Once per 1,000 cy	100% passing the 3/8 inch sieve and less than 5% passing the number 200 sieve
Permeability	ASTM D2434-68	Once per 3,000 cy	Minimum permeability of 1×10^{-2} cm/sec

- F. The results of all testing shall be submitted to the Engineer for approval. Any materials not meeting the requirements of this section shall be considered as spoil.
- G. If at any time during this Contract the Engineer requests further soils testing to determine if the characteristics of the drainage layer material obtained from the borrow area(s) have

changed, the Contractor shall perform these tests at no additional cost to the State.

PART 3 - EXECUTION

3.01 DRAINAGE LAYER MATERIAL

- A. Placement of the drainage layer material shall be in accordance with the provisions of this Section. The Contractor shall proceed with caution when placing the drainage layer to minimize damage, since the drainage layer is to be placed directly atop a plastic membrane or geotextile which must not be damaged. Any drainage layer material which cannot comply with the provisions of this Section will be considered as spoil and will be removed and disposed of at the Contractor's expense.
- B. The drainage layer shall be carefully placed to the required thickness as specified in the Contract Drawings.
- C. The Contractor shall take care to insure that:
 - 1. The flexible membrane cover remains intact during the installation of the drainage layer.
 - 2. No vehicles shall drive on the uncovered flexible membrane cover.
- D. Sufficient compaction shall be provided to provide a stable working platform for placement of additional cap components.
- E. Any damage to the completed surface of the drainage layer, whether caused by erosion, the Contractor's work, or any other occurrences, shall be immediately repaired and maintained in good condition until completion of the work.
- F. Any damage to pipe or flexible membrane cover occurring during installation of the drainage layer shall be replaced at no additional cost to the State.

- END OF SECTION -

SECTION 02293
VEGETATIVE LAYER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation, backfilling, and compacting including the loosening, removing, working, transporting, storage, fill, and disposal of all materials necessary for construction of the vegetative layer, as shown or specified or as directed by the Engineer.

B. Related Work Specified Elsewhere:

1. Geotextiles Used as Filter Fabrics: Section 02296
2. Topsoil and Seeding: Section 02980
3. Flexible Membrane Cover: Section 02294

1.02 TESTING

- A. All soil testing services as specified herein necessary for the Contractor to obtain an approved vegetative layer material shall be provided by the Contractor. All testing including laboratory and field services required during construction of the vegetative layer shall be provided by the Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM D422-63	Method for Particle Size Analysis of Soil
ASTM D698-78	Method for Moisture - Density Relations of Soils and Soil - Aggregate Mixtures Using 5-lb. Rammer and 12-in. Drop.
ASTM D4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D1556-82	Test Method for Density of Soil In Place by the Sand-Cone Method
ASTM D2992-81	Test Methods for Density of Soil and Soil - Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2167-84	Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method

1.04 SUBMITTALS

- A. Source of borrow materials for vegetative layer.

- D. The geotextile shall conform to the following physical strength requirements:

<u>Property</u>	<u>Standard</u>	<u>Criteria</u>
Geotextile Permittivity	ASTM D 4491-85	Minimum permittivity of 0.2 sec ⁻¹
Mass per Unit	ASTM D 3776-85	Minimum 12 oz/yd ²
Grab Tensile Strength	ASTM D 4632-86	300 lbs.
Grab Tensile Elongation	ASTM D 4632-86	60%
Trapezoid Tear	ASTM D 4533-85	125 lbs.
Puncture Strength	ASTM D 3786-87	150 lbs.
Burt Strength	ASTM D 3787-89	600 psi

- E. The geotextile filter openings shall be sized in accordance with the following criteria which takes into consideration the soil found in the finest layer located adjacent to the geotextile filter:

$$\frac{O_{95} \text{ of the geotextile}}{d_{85} \text{ of the soil}} \text{ less than } 2$$

$$\frac{O_{95} \text{ of the geotextile}}{d_{15} \text{ of the soil}} \text{ greater than } 2$$

Where d_{85} is the soil particle size at which 85 percent of the particles are finer, and d_{15} is the soil particle size at which 15 percent of the particles are finer. The O_{95} is the apparent opening size of the geotextile at which 95 percent of the soil particles will pass and shall be determined in accordance with ASTM D 4751-87.

- F. The seams of the geotextile shall be seamed with thread meeting the chemical requirements given in Section 2.A.1 for geotextile thread. The thread shall be capable of supplying a seam strength efficiency of 80% of the required tensile strength utilizing a Type 401 two-thread chainstitch with a "J" seam. The seam shall have 8 stitches per inch and the stitches shall be a minimum of 2 inches from the fabric edge. If requested by the Engineer, the Contractor shall perform laboratory tests in accordance with ASTM D 4884-89 at no cost to the Owner. The sheets of geotextile shall be attached at the factory or another approved location of form sections not less than 24 feet wide.
- G. During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultraviolet light, temperatures greater than 140°F, mud, dirt, dust, and debris.

To the extent possible, the geotextile shall be maintained wrapped in a heavy duty protective covering.

2.02 TEMPORARY PINS

- A. Temporary securing pins shall be 3/16 inches in diameter, of steel, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1.5 inches. The pins shall be no longer than nine (9) inches.

PART 3 - EXECUTION

3.01 GEOTEXTILE FILTER FABRIC

- A. Prior to installation of the geotextile filter fabric, the material on which the filter fabric is to be installed will be free of organic matter, irregularities, protrusions, and any abrupt changes in grade that could damage the filter fabric. The supporting layer will be maintained in a smooth, uniform, and compacted condition during installation of the filter fabric.
- B. The geotextile shall be placed in manner and at the locations shown on the drawings. At the time of the installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.
- C. The geotextile shall be placed with the long dimension parallel to the line of maximum slope and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide minimum overlaps of 18 inches.
- D. Temporary pinning of the geotextile into the drainage layer to help hold it in place shall be allowed. Temporary pinning of the geotextile will not be permitted on the surface of the soil barrier layer. The Contractor shall take extreme care not to puncture the flexible membrane cover. If the FMC is punctured, it shall be repaired by the Contractor at no additional cost to the State. The temporary pins shall be removed as the soil layers are placed to relieve high tensile stress which may occur during placement of material on the geotextile. Additional pins regardless of location shall be installed as necessary to prevent any slippage of the geotextile. The geotextile shall be placed so that the upper strip of geotextile will overlap the next lower strip by a minimum of 18 inches. Each securing pin shall be pushed through the geotextile until the washer bears against the geotextile and secures it firmly to the foundation.
- E. The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of soil layers shall be replaced by the Contractor at the Contractor's expense.

- F. The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 5 days after placement of the geotextile. Failure to comply shall require replacement of geotextile.
- G. The geotextile shall be protected from damage due to the placement of materials by limiting the height of drop of the material to less than 1 foot.

- END OF SECTION -

SECTION 02297

GABIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Excavation, backfilling, assembly, transporting, storage, fill, and disposal of all material necessary for construction of gabions as shown or specified or as directed by the Engineer.

B. Related Work Specified Elsewhere

1. Select Fill: Section 02230

1.02 TESTING

- A. All testing services as specified herein necessary for the Contractor to obtain an approved material for the gabions shall be provided by the Contractor. All testing including laboratory and field services required during construction of the gabions shall be provided by the Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM A 90-81	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM B 117-85	Method of Salt Spray (Fog) Testing
ASTM D 412-87	Test Methods for Rubber Properties in Tension
ASTM A 641-89	Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM D 792-86	Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D 1203-89	Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods

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| ASTM D 1242-87 | Test Methods for Resistance of Plastic Materials to Abrasion |
| ASTM D 1499-84 | Recommended Practice for Operating Light and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics |
| ASTM D 1557-78 | Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop |
| ASTM D 2167-84 | Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method |
| ASTM D 2240-86 | Test Method for Rubber Property - Durometer Hardness |
| ASTM D 2287-81 | Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds |
| ASTM G 23-89 | Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials |
- B. U.S. Federal Specification QQ-W-461H. Steel Wire Carbon For General Use.
- C. British Standard Specification (BSS) 2782-104A Methods of Testing Plastics.
- D. American Association of State Highway and Transportation Officials (AASHTO).
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| AASHTO T 2 | Sampling Stone, Slag, Gravel, Sand and Stone Block for use as Highway Materials. |
| AASHTO T 96 | Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine. |
- E. New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction Section 9.01 - Aggregates. Appendix A-3 - Soundness of Aggregates by Use of Sodium Sulfate.

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| ASTM D 1242-87 | Test Methods for Resistance of Plastic Materials to Abrasion |
| ASTM D 1499-84 | Recommended Practice for Operating Light and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics |
| ASTM D 1557-78 | Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop |
| ASTM D 2167-84 | Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method |
| ASTM D 2240-86 | Test Method for Rubber Property - Durometer Hardness |
| ASTM D 2287-81 | Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds |
| ASTM G 23-89 | Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials |
- B. U.S. Federal Specification QQ-W-461H. Steel Wire Carbon For General Use.
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- E. New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction Section 9.01 - Aggregates. Appendix A-3 - Soundness of Aggregates by Use of Sodium Sulfate.

1.04 SUBMITTALS

- A. Manufacturer's certification that the gabions meet the requirements of this Section.
- B. Source of borrow material for rock fill material.
- C. Certification of rock fill material.
- D. Samples of rock fill material.

- E. Laboratory certification of rock fill material if laboratory testing required by the Engineer.

PART 2 - PRODUCTS

2.01 GABIONS

A. General

1. The PVC coated gabion shall be a flexible zinc coated gabion of the type and size specified in this Section.
2. The gabion shall be made of wire mesh of the type and size and selvages as specified in this Section.
3. Standard gabions shall be fabricated so as to be of a single unit construction - base, lids, and sides shall be woven into a single unit and the ends connected to the base section in such a manner that strength and flexibility of the point of connection is at least equal to that of the mesh.

B. Mesh

1. The mesh shall be hexagonal woven mesh with triple twisted joints formed by twisting each pair of wires through three half turns. The size of the mesh shall be of type 8 x 10. Nominal mesh size is 3-1/4 by 4-1/2 inches.

C. Wires

1. All wire used in fabrication of the gabions and in the wiring operations during construction shall conform to or exceed the requirements of the U.S. Federal Specification QQ-W-461H of November, 1978 Class 3 Finish soft wire. The wire shall have an average tensile strength in accordance with ASTM A641-89 before extrusion of PVC coating and fabrication of the netting. The nominal diameter of the wire used in the fabrication of the netting shall be 0.1063 inches.
2. The nominal diameter of the steel wire core used in the fabrication of the netting shall be 0.1063 inches with a PVC coating, extruded onto the wire core, having a nominal thickness of 0.02165 inches. An overall nominal diameter of 0.1496 inches is required.
3. Tests shall be made on the wire before coating with PVC and fabrication of the gabions of a sample ten inches long. Elongation shall not be less than 12 percent.
4. Tolerances on the diameter of all wire shall be permitted in accordance with ASTM D641-89, Table 3.

D. Zinc Coating (Galvanizing)

1. All wire used in the fabrication of the gabions during construction shall be coated to ASTM A641-89 Zinc Coated (galvanized) carbon steel wire. The minimum weight of the zinc coating shall be in accordance to the following when tested in accordance with ASTM A90-81:

<u>Nominal Diameter of Wire</u>	<u>Minimum Weight of Coating</u>
0.0866 inches	0.70 ozs/sq.ft.
0.1063 inches	0.80 ozs/sq.ft.
0.1338 inches	0.80 ozs/sq.ft.

2. The adhesion of the zinc coating to the wire shall be such that when the wire is wrapped six turns around a mandrel of 4 times the diameter of the wire, it does not flake or crack to such an extent that any zinc can be removed by rubbing with bare fingers.

E. Selvedges

1. All edges of the PVC coated gabions including end-panels and the diaphragms, if included, shall be mechanically selvedged in such a way as to prevent ravelling of the mesh and to develop the full strength of the mesh.
2. The wire used for the selvedge shall have a diameter greater than that of the wire used to form the mesh. For the 8 x 10 type wire mesh made of wire having a nominal core diameter of 0.1063 inches, the selvedge shall be of wire having a nominal diameter of 0.1338 inches or greater.

F. Dimensions

1. Nominal length = 9 feet;
Nominal width = 3 feet;
Nominal Height = 3 feet, 1.5 feet, 1.0 feet (varies)
2. Tolerances of $\pm 5\%$ on the width, height, and length of the gabions shall be permitted.

G. Lacing Wire

1. Sufficient lacing and connecting PVC coated wire shall be supplied with the gabions for all wiring operations carried out in the construction of the gabion work.

H. Rings

1. Stainless steel hog rings may be substituted for lacing wire in initial assembly if manufactured by Spenax Corporation or as approved by the Engineer.

I. P.V.C. Coating

1. All wire used in the fabrication of the gabions and in the wiring operations during construction shall, after zinc coating have extruded onto it a coating of poly vinyl chloride, otherwise referred to as "P.V.C.". The coating shall be grey in color, of nominal thickness of 0.02165 inches, and shall nowhere be less than 0.015 inches in thickness. Tolerances on the diameter of wire shall be permitted in accordance with ASTM D641-89 Table 3. It shall be capable of resisting deleterious effects of natural weather exposure, immersion in salt water, and shall not show any material difference in its initial characteristics as follows:

<u>Parameter</u>	<u>Standard</u>	<u>Criteria</u>
Specific Gravity	ASTM D2287-81, Table 1 when tested in accordance with ASTM D792-86	1.30 to 1.35 kg/Dm ³
Durometer Hardness	ASTM D2287-81, Table 1 when tested in accordance with ASTM D2240-86	50 to 60 in Shore D
Volatile Loss	ASTM D2287-81, Table 1 when tested in accordance with ASTM D1203-89	not greater than 2% at 105° for 24 hours not greater than 6% at 105°C for 240 hours
Tensile Strength	ASTM D412-87	not less than 210 Kg/cm ³
Elongation	ASTM D412-87	not less than 200% nor higher than 280%
Modulus of Elasticity at 100% of elongation	ASTM D412-87	not less than 190 Kg/cm ³
Resistance to Abrasion	ASTM D1242-87	loss of weight not more than 0.19 g
Brittleness Temperature	BSS 2782-104A	Cold bend temperature not higher than -30°C
Creeping Corrosion	(1)	(1)

- (1) Maximum penetration of corrosion of the wire core from a square cut end shall be 25 mm when the specimen has been immersed for 2000 hours in a 50% solution of HCl (hydrochloric acid 12 Be).

Variation of the initial properties shall be allowed, as specified hereunder, when the specimen is submitted to the following accelerated aging tests:

Salt Spray	ASTM B117-85	Period of test 1500 hours
Exposure to ultraviolet rays	ASTM D1499-84 and ASTM G23-89	Period of test 2000 hours at 63°
Exposure at high temperature	ASTM D1203-89 and ASTM D2287-81	Period of test 240 hours at 105°C

After the above tests have been performed the P.V.C. compound shall show the following properties:

<u>Parameter</u>	<u>Criteria</u>
Appearance of Coated Mesh	The vinyl coating shall not crack, blister, or split and shall not show any remarkable change in color
Specific Gravity	Shall not show change higher than 6% of its initial value
Durometer Hardness	Shall not show change higher than 10% of its initial value
Tensile Strength	Shall not shown change higher than 25% of its initial value
Elongation	Shall not show change higher than 25% of its initial value
Modulus of Elasticity	Shall not show change higher than 25% of its initial value
Resistance to abrasion	Shall not show change of more than 10% of its initial value
Brittleness Temperature higher	Cold Bend Temperature shall not be than -20°C Cold Flex Temperature shall not be higher than +18°C

J. Diaphragms

1. The gabions shall incorporate diaphragms not greater than 1.5 times the width of the gabion to form the cells.

2.02 ROCK FILL

- A. The rock fill material shall consist of hard, durable stone meeting the qualifications of Subsection 901.04 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction or other hard durable rock, and shall be greater in diameter than the openings of the mesh (graded between 4 to 8 inches).
- B. The rock shall be sound, free from weathered or decomposed pieces, shattered ends, and structural defects. The rock fill material shall be free of hazardous materials in accordance with the Special Provisions.
- C. The rock fill shall be obtained from a source approved by the Engineer.
- D. Samples of the rock fill shall be taken in accordance with AASHTO T 2.
- E. The broken stone shall meet the following requirements:

<u>Parameter</u>	<u>Criteria</u>
Weathered and Decomposed Stone	Maximum 5 percent
Broken stone other than that classification approved for use	Maximum 5 percent
Flat or elongated pieces (length greater than 4 times maximum thickness or width)	Maximum 7 percent
Sodium sulfate soundness, loss	Maximum 10 percent in accordance with NJDOT A-3
Percent of wear (Los Angeles (Test))	Maximum 50 percent in accordance with AASHTO T 96

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

- A. Subgrade in areas where gabions are to be constructed shall consist of select fill as shown on the drawings.
- B. Subgrade material shall be compacted to 95% of the maximum dry density as determined in accordance with ASTM D1557-78.

3.02 INSTALLATION

- A. Gabions
 1. Gabions shall be assembled in accordance with manufacturer's recommendations.

2. Adjacent gabions must be laced along the perimeter of all contact surfaces.
3. Gabions shall be placed empty and laced for a distance of a minimum of 100 linear feet. The first gabion shall be firmly anchored and tension shall be applied to the other end by appropriate methods. Anchoring shall be accomplished by partially filling the first gabion with stone.
4. The gabions shall be kept in tension while being filled.

B. Rock fill

1. Gabions shall be filled in one foot lifts. Two connecting wires shall be placed between each lift in each cell of all exposed faces.
2. The mesh forming the lid shall be stretched tight when the gabion is wired in order to avoid movement of the fill.
3. Stone shall be dumped from the lowest practicable position.
4. Appropriate methods shall be used to protect the top edges of the diaphragms and end panels from being bent or folded by the stone during placement.

- END OF SECTION -

SECTION 02299
GAS EXTRACTION WELLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

The work to be done under this Section includes the furnishing of all labor, material, transportation, tools, supplies, equipment and appurtenances necessary for complete and satisfactory construction, and testing of gas extraction wells at the locations shown on the Contract Drawings.

B. Definitions

1. Perimeter gas extraction wells shall be defined as gas extraction wells within 50 feet of the landfill perimeter. All other gas extraction wells shall be defined as landfill gas extraction wells.

1.02 QUALITY ASSURANCE

A. Acceptable PVC riser pipe, well screen and piezometer tip manufacture

1. Timco Manufacturing Co.
2. Johnson Well Screens
3. Approved Equal

B. Acceptable Bentonite Manufacturers

1. American Colloid Co.
2. Dow Chemical Co., Dowell Division
3. Approved equal

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM)

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| ASTM D422-63 | Method for Particle Size Analysis of Soils |
| ASTM D1785-89 | Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120 |

1.04 SUBMITTALS

- A. Detailed shop drawings and manufacturer's data concerning the PVC riser pipe; pipe joints, fittings, PVC well screens shall be submitted.
- B. Test Results and Manufacturers Certification of Granular Material.
- C. Test Results and Manufacturers Certification of Bentonite.
- D. State of New Jersey Well Permits (if required).
- E. Log of Well Data.

PART 2 - PRODUCTS

2.01 PVC RISER PIPE

- A. Specified Pipe
 - 1. The riser pipe shall be 4-inch and 6-inch diameter as shown on the Contract Drawings, threaded flush joint, schedule 80 PVC pipe.

2.02 PVC WELL SCREENS

- A. Specified Well Screen
 - 1. The well screen shall be 4-inch and 6-inch diameter as shown on the Contract Drawings, threaded flush joint, slotted with 0.060 inch slots, schedule 80 PVC pipe with threaded PVC plug in bottom.

2.03 GRANULAR MATERIAL

- A. Specified Materials
 - 1. The granular material used to backfill the annular space between the well screen and the boring hole shall be a washed gravel of the following specifications as approved by the Engineer:

<u>Grain Size</u>	<u>Percent Retained</u>
1.4 mm	86-100%
1.98 mm	67-83%
2.79 mm	42-58%
3.18 mm	27-43%
3.96 mm	0-16%

- 2. Results of testing on granular material conducted in accordance with ASTM D422-63 along with manufacturers

- B. Location of spoil areas.
- C. Location of samples collected within borrow areas for laboratory testing.
- D. Proposed soil testing laboratory.
- E. Laboratory testing methods to be used.
- F. Results of laboratory testing methods.
- G. Laboratory certification of vegetative layer material.
- H. Required surface disturbance permits.

PART 2 - PRODUCTS

2.01 VEGETATIVE LAYER MATERIAL

- A. The vegetative layer material will be free of hazardous materials in accordance with the Special Provisions.

The Contractor should exercise reasonable care to avoid using contaminated materials. Routine analyses is not necessarily required but the State reserves the right to test suspect materials at the State's expense and reject them if the material exceeds the limits. The rejected materials shall be removed from the site even if they have been incorporated into the work.

- B. Vegetative layer material shall be obtained from a source approved by the Engineer.
- C. The vegetative layer shall be classified as a silty sand (SM), silty clay (SC), or SM-SC material in accordance with the Unified Soil Classification System (USCS) based on results of testing performed in accordance with ASTM D422-63 and ASTM D4318-84. The vegetative layer material shall have a composition as follows:

<u>% Passing</u>	<u>Sieve</u>
100	2 inch
80-95	No. 4
65-70	No. 40
12-20	No. 200

- D. The vegetative layer material must be uniform in composition and texture, clean and free from stones, weeds, stumps, roots, toxic substances, and debris or similar substances 2 inches or more in greatest dimension. The vegetative layer material shall have physical and chemical characteristics conducive to the establishment of vegetation.
- E. The Contractor shall submit testing methods (prior to conducting tests), test results, and a certification from the approved

soils testing laboratory that the vegetative layer material meets the requirements of this section. A locally available vegetative layer material may be used if it meets the requirements specified in this section. The results of all soils testing specified herein shall be submitted to the Engineer for approval.

- F. During installation of the vegetative layer, material from the borrow source shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle Size Analysis	ASTM D422-63	Once per 3,200 cy	Material meets the Unified Soil Classification System (USCS) Designation of silty sand (SM), clayey sand (SC), or SM-SC.
Liquid Limit, Plastic Limit, Plasticity Index	ASTM D4318-84	Once per 3,200 cy	Material meets the Unified Soil Classification System (USCS) Designation of silty sand (SM), clayey sand (SC), or SM-SC.
In-Place Density*	ASTM D1556-82 or ASTM D2922-81 or ASTM D2167-84	5 tests per acre per lift of soil placed	90% of the Standard Proctor Compaction as determined by ASTM 1557-78

- * Testing performed using ASTM D2922-81 shall be duplicated at a rate of 10% utilizing either ASTM D1556-82 or ASTM D2167-84 adjacent to the testing performed by ASTM D2922-81. The Contractor shall provide an explanation between the differences in duplicate testing.

- G. The results of all testing shall be submitted to the Engineer for approval. Any materials not meeting the requirements of this section shall be considered as spoil.
- H. If at any time during this Contract the Engineer requests further soils testing to insure that the characteristics of the vegetative layer material obtained from the borrow area(s) have not changed, the Contractor shall perform these tests at no additional cost to the State.

PART 3 - EXECUTION

3.01 VEGETATIVE LAYER MATERIAL

- A. Placement of the vegetative layer material shall be in accordance with the provisions of this Section. Any vegetative layer material which cannot comply with the provisions of this Section will be considered as spoil and will be removed and disposed of at the Contractor's expense.
- B. The vegetative layer material shall be constructed by placing suitable material in 6-inch lifts. Compaction of the lifts shall be accomplished by a smooth wheel vibratory roller or other suitable equipment. Compaction of the vegetative layer shall be 90 percent of the Standard Proctor Compaction as determined by ASTM 698-78. Testing shall be conducted at a minimum frequency of 1 test per 10,000 square feet. Tests shall be areally distributed.
- C. Compaction or consolidation achieved by traveling trucks, machines, and other equipment will not be accepted unless such procedures are approved by the Engineer and proper compaction criteria are achieved.
- D. Any damage to the completed surface of the vegetative layer, whether caused by erosion, the Contractor's work, or any other occurrences, shall be immediately repaired and maintained in good condition until completion of the work.

- END OF SECTION -

SECTION 02294

FLEXIBLE MEMBRANE COVER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Manufacturing, fabrication, furnishing, and installation of the flexible membrane cover. All work shall be performed in strict accordance with the liner manufacturer's recommendations, as approved by the Engineer, the drawings and these specifications. The flexible membrane cover shall be composed of very low density polyethylene with a minimum thickness of 40 mils.

B. Related Work Specified Elsewhere

1. Soil Barrier Layer: Section 02290
2. Soil Barrier Layer with Bentonite: Section 02291
3. Geotextiles Used as Filter Fabrics: Section 02296
4. Drainage Layer: Section 02292
5. Vegetative Layer: Section 02293

1.02 DEFINITIONS

- A. Fabricator: A factory converter of narrow geomembrane sheets into panels by dielectric bonded solvent adhesive, or fusion methods.
- B. FMC: Abbreviation for Geomembrane Flexible Membrane Cover.
- C. Installer: The person or corporation hired by the Contractor who is responsible for field handling, deploying, seaming, field QC testing and anchoring the FMC panels.
- D. Inspector: The third party construction quality control (CQC) person or corporation hired by the Contractor, independent from the manufacturer, fabricator, and installer, who is responsible for observing and documenting activities related to the quality control of the FMC from manufacture through installation.
- E. Independent Laboratory: The third party construction quality assurance (CQA) lab hired by the Contractor, independent from the manufacturer, fabricator and installer who is responsible for quality control FMC seam testing.

- F. Manufacturer: The producer of geomembrane rolls by the blown-film process or the flat extrusion process.
- G. Panel: A factory-fabricated FMC composed of several narrow width FMC sheets seamed into one large unit.
- H. Roll: A manufactured seamless FMC sheet with a width equal to or greater than 15 feet.
- I. VLDPE-A: Abbreviation for very low density polyethylene-alloy.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specifications to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM).

- | | |
|----------------|---|
| ASTM D413-82 | Test Methods for Rubber Property--Adhesion to Flexible Substrate |
| ASTM D638-89 | Test methods for Tensile Properties of Plastics |
| ASTM D746-79 | Test Method for Brittleness Temperature of Plastics and Elastomers by Impact |
| ASTM D 1004-66 | Test Method for Initial Tear Resistance of Plastic Film and Sheeting |
| ASTM D1204-84 | Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting of Film at Elevated Temperature |
| ASTM D1238-89 | Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer |
| ASTM D1243-79 | Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer |
| ASTM D1505-85 | Test Method for Density of Plastics by the Density-Gradient Technique |
| ASTM D1593-89 | Specification for Nonrigid Vinyl Chloride Plastic Sheeting |
| ASTM D1603-76 | Test Method for Carbon Blank in Olefin Plastics |
| ASTM D1693-70 | Test Method for Environmental Stress-Cracking of Ethylene Plastics |
| ASTM D3015-72 | Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds |

ASTM D3083-89 Specification for Flexible Poly (Vinyl Chloride)
Plastic Sheetting for Pond, Canal and Reservoir
Lining

B. Federal Test Method Standards (FTMS)

101 C 2065.1

C. National Sanitation Foundation (NSF)

Standard 54 Standard for Flexible Membrane Liners

1.04 SUBMITTALS

A. Resin Supplier Submittals

1. Certification that the resin is new, first quality resin produced in the United States which meets or exceeds the requirements specified hereinafter and is free of contaminants.
2. Production date(s) of the resin.
3. Copy of quality control certificates.

B. Manufacturer Submittals

1. Certification of production capacity and schedule availability to meet this contract.
2. Quality control program manual and copy of quality control certificates.
3. Certified test results for all material properties specified.
4. Certification that no reclaimed polymer, no more than 2% recycled and no work off material is added to the virgin resin during the manufacture of the FMC.
5. List of at least five completed facilities totaling a minimum of two million square feet with at least one million square feet of projects using the same FMC thickness as specified for this contract.

C. Fabricator Submittals

1. Quality control program manual and copy of quality control certificates.
2. Certified seam test results.
3. Two samples of typical fabricated seams.
4. Geomembrane thickness measurements.

5. List of at least five completed facilities for which the fabricator has fabricated the proposed FMC panels totaling a minimum of two million square feet.

D. Installer Submittals

1. Quality control program manual.
2. Two samples of typical field seams.
3. List of at least five completed facilities for which the installer has installed the proposed FMC panels/rolls totaling a minimum of two million square feet with at least one million square feet of projects using the same FMC thickness as specified for this contract. For each installation, the following information shall be provided:
 - Name of facility, location, date of installation, type of application, type of seaming system, and name of the installing supervisor
 - Name of owner, designer, manufacturer, fabricator, and name and telephone number of a facility contact who can discuss status of the installation
 - Thickness of the FMC and surface area and type of seaming system.
4. Resumes of the qualifications of the installation supervisor and personnel performing field seaming operations for this project.
5. Daily seam strength test values for peel, adhesion and bonded seam shear strength.
6. Weekly update copies of the as-built drawings.
7. Notification of any equipment or material problems within eight hours of the occurrence and the proposed course of corrective action.
8. Samples of all report/documentation forms.

E. Contractor Submittals

1. Direct shear test method and laboratory qualifications.
2. Certified friction test results on cap system components.

F. Qualification Submittals

1. Manufacturer shall demonstrate qualification by having successfully manufactured at least two million square feet of the proposed FMC.

2. Fabricator shall demonstrate qualification by having successfully fabricated at least two million square feet of the proposed FMC.
3. Installer shall demonstrate qualification by having successfully installed at least two million square feet of the proposed FMC. All personnel performing seaming operations shall be qualified by experience or will be required to pass a seaming test in accordance with this Section. At least one master seamer shall have experience seaming a minimum of one million square feet of the proposed FMC using the same type of seaming equipment and FMC mil thickness specified for this project.
4. Inspector shall demonstrate qualification by having successfully inspected at least two million square feet of the proposed FMC and have a working knowledge of the proposed seaming equipment.

1.05 EQUIPMENT

- A. All equipment, tools and machines used in performance of the work shall be subject to approval by the Engineer prior to commencement of work. This equipment shall be maintained in satisfactory working condition at all times.

1.06 DELIVERY, STORAGE AND HANDLING.

- A. The FMC materials shall be packaged and shipped by appropriate means so that no damage is incurred. Materials shall be delivered only after the required submittals have been received and approved by the Engineer. No off-loading shall be done unless the Inspector is present. The FMC shall be adequately protected to prevent degradation of the material and adhesion of individual whorls of a roll or layers. If outdoors, the FMC shall be stored in the unopened crates. The FMC shall be stored on pallets and shall be protected from the direct rays of the sun under a light-colored, heat-reflective, opaque cover in a manner that provides a free-flowing air space between the crate and cover. Appropriate handling equipment and techniques, as recommended by the manufacturer/fabricator and approved by the Engineer, shall be used. Any FMC damaged as a result of poor delivery, storage, or handling methods shall be repaired or replaced, as determined by the Engineer, at no additional cost to the State.

1.07 AS-BUILT DRAWINGS

- A. The Contractor shall provide as-built drawings which shall be updated weekly, showing panel/roll numbers, layout plan, seam numbers, and the location of patches, destructive seam samples, anchorage details, and penetrations.

PART 2 - PRODUCTS

2.01 RAW MATERIALS

A. VLDPE-A

1. The materials used in production of VLDPE-A roll stock shall be 100 percent domestic, first-quality raw materials, using no more than 2% recycled ingredients. The Contractor shall provide certification that the resin meets or exceeds the requirements along with a copy of the quality control certificates.

2.02 VLDPE-A SHEET MATERIALS

- A. The VLDPE-A sheets shall be uniform in color, thickness, size, and surface texture.
- B. The VLDPE-A sheets shall be free of pinholes, blisters, nodules, and contaminants and other imperfections.
- C. The VLDPE-A sheets shall conform to the physical requirements listed in Table 1.
- D. The Contractor shall provide certified test results for all material properties specified along with a copy of the Manufacturer's quality control program manual and quality control certificates.

2.03 VLDPE PANEL FABRICATION

- A. Where possible VLDPE sheets, when less than 22 ft. wide, shall be factory seamed into maximum sized panels so as to minimize field seaming.
- B. All factory seams shall be made by wedge welding and meet the minimum bonded seam and peel strength requirements shown in Table 1.

TABLE 1. VLDPE-A FMC PROPERTIES

Property	Test Method	Test Value
Gauge (nominal)	--	40 mils
Thickness, absolute minimum	ASTM D 1593-89	40 mils
Density	ASTM D 1505-85	0.900 to 0.935
Melt Index, maximum	ASTM D 1238-89	0.6 g/10 minutes
Carbon Black Content	ASTM D 1603-76	2-3%
Carbon Black Dispersion	ASTM D 3015-72	A-2
Minimum Tensile Properties	ASTM D 638-89	--
1. Tensile Strength @ Break	Type IV Specimen	120 lg./in. width
2. Elongation @ Break	@ 20 in./minute	1,000%
3. Modulus of Elasticity		15,000 psi
Tear Resistance, minimum	ASTM D 1004-66, Die C	14 lb.
Puncture Resistance	FTMS 101C 2065	49 lb.
Low Temperature Brittleness	ASTM D 746-79	-94°F.
Dimensional Stability (maximum change)	ASTM D 1204-84 15 min. @ 212°F.	±3%
Resistance to Soil Burial (percent change maximum in original value)	ASTM D 3083-89 Type IV Specimen @ 20 in./minute	10% 10%
1. Tensile Strength @ Break		
2. Elongation @ Break		
Environmental Stress Crack (minimum, hours)	ASTM D 1693-70 Condition C (as modified by NSF 54)	1500 hrs.
FACTORY AND FIELD SEAM REQUIREMENTS		
1. Bonded Seam Strength, (minimum)	ASTM D 3083-89 (as modified by NSF 54)	40 lb./in. width or 20" elongation
2. Peel Adhesion, minimum	ASTM D 413-82 (as modified by NSF 54)	film tear bond
3. Resistance to Soil Burial (% change max. in orig. value)	ASTM D 3083-89 (as modified by NSF 54)	
a. Bonded Seam Strength		-20%
b. Peel Adhesion		-2%

2.04 SAMPLING AND TESTING.

A. General Requirements

1. All testing services as specified herein necessary for installation of the FMC shall be provided by the Contractor. All testing including laboratory and field services required during construction of the FMC shall be provided by the Contractor.
2. FMC testing shall be performed by a testing laboratory approved by the Engineer.
3. The Contractor shall provide at least 2 days notice prior to testing. The Contractor shall provide transportation for the Construction Manager and Engineer to and from the test site upon request.

B. Friction Testing

1. The FMC shall not be placed on slopes exceeding one (1) vertical or ten (10) horizontal. The Contractor shall perform laboratory friction tests using a direct shear test method as approved by the Engineer to assure a minimum friction angle of 12° degrees can be obtained between all cap system components in contact with the geomembrane. Friction testing shall be performed with a direct shear box with minimum dimensions of 12 inches by 12 inches and applied normal stresses of 1.0, 2.0, and 4.0 psi for each cap system interface. Displacement rates shall be less than 0.1 inches per minute. All cap system components shall be tested in a saturated condition. The FMC and geotextile shall be oriented such that the shear force is paralleled to the downslope orientation of the geotextile and FMC in the field. These tests shall be performed and the results approved by the Engineer prior to delivery of the cap system components.

C. Manufacturing Testing

1. Each resin batch shall be tested to ensure the consistency of the raw material quality. Any resin batch which fails to meet all the specified physical properties shall not be accepted for manufacturing the liner. The FMC sheets shall be randomly sampled and tested at a minimum once every 40,000 square feet to evaluate the required physical properties. Certified test results on each sample shall be submitted. In addition, one minimum 12 inch by 12 inch size sample specimen, along with appropriate identification, shall be provided to the State for further testing if desired. The Contractor shall provide the State with a permanent record of actual furnished material. Samples not meeting the minimum requirements specified shall result in the rejection of the applicable rolls.

D. Fabrication Testing

1. Prior to factory seaming, all roll goods shall be inspected on both sides for defects and impurities. All defects and impurities shall be removed and repaired prior to being fabricated into panels. Thickness measurements shall be made at the center and each edge of the beginning and end of each roll of material used for this project. All measurements shall be submitted by the Contractor to the Engineer/Construction Manager. Any roll having a thickness less than the minimum value specified herein shall be rejected.
2. Prior to shipping to the site, non-destructive tests shall be run on all fabricated seams over their full length using the appropriate test unit and procedure as outlined in this Section. Any deviation of these procedures shall be subject to approval by the Engineer prior to use. All VLDPE-A factory seams shall be vacuum tested or air pressure tested (for double wedge process only). Any seam which fails shall be documented and repaired in accordance with this Section.
3. Destructive Factory Seam Testing
 - a. Prior to shipping to the site, a minimum of one destructive test sample per 500 feet of factory seam length shall be taken. Where possible, these samples shall be taken from extra material at the beginning or end of panel seams such that the panel is not damaged and the panel geometry is not altered.
 - b. The samples shall be a minimum of 18 inches wide by 60 inches long with the seam centered lengthwise. Each sample shall be cut into three pieces with one piece (18 inches by 24 inches) retained by the fabricator, one piece given to an independent laboratory, and one piece given to the State for further testing if desired and permanent record. Each sample shall be tagged to identify: (1) manufacturer's roll number; (2) date cut; (3) panel from which cut; (4) location in panel; (5) visual inspection comments; (6) inspector's name and (7) top sheet.
 - c. Ten 1 inch wide replicate specimens shall be cut from the fabricator sample. Five specimens shall be tested for bonded seam strength and five for peel adhesion. To be acceptable, four out of five replicate test specimens must meet the specific property requirements.

- d. The test procedures to be used by the independent laboratory shall be the same as defined in this Section.

E. Field Sampling and Testing

1. Non-Destructive Field Seam Testing

- a. The Engineer shall non-destructively test all field seams over their full length using the appropriate test unit and procedure as outlined in this Section. Any deviation of these procedures shall be subject to approval by the Engineer prior to use. Testing shall be performed as the seaming work progresses, not at the completion of field seaming. All VLDPE-A field seams shall be vacuum tested or air pressure tested (for double wedge process only). Any seams which fail shall be documented and repaired in accordance with this Section.

2. Destructive Field Seam Testing

- a. The Contractor shall obtain a minimum of one destructive test sample per 500 feet of field seam length at locations specified by the Inspector and approved by the Engineer/Construction Manager. When possible, these samples shall be taken from extra material at the beginning or end of panel seams such that the panel is not damaged and the panel geometry is not altered.
- b. The samples shall be a minimum of 18 inches wide by 60 inches long with the seam centered lengthwise. Each sample shall be cut into three pieces with one piece (18 inches by 24 inches) retained by the installer, one piece given to an independent laboratory, and the remaining piece given to the State for further testing if desired and permanent record. Each sample shall be tagged to identify: (1) roll/panel number; (2) seam number; (3) date and time cut; (4) ambient temperature; (5) seaming unit; (6) name of seamer; and (7) welding apparatus temperature and pressures and (8) top sheet.
- c. The Contractor shall cut six 1 inch wide replicate specimens from his sample using the appropriate ASTM cutting tool. Three specimens shall be tested for bonded seam strength and three for peel adhesion. To be acceptable, two out of three replicate test specimens must meet the specified property requirements. If the field tests pass, independent laboratory testing shall be conducted in accordance with this Section. If the field tests fail, the seam shall be repaired in accordance with this

Section. Certified test results on all seams shall be submitted prior to acceptance of the seam.

- d. The test procedures to be used by the independent laboratory shall be the same as defined in this Section.

F. Non-Destructive Seam Testing Procedures

1. Vacuum Test

- a. The vacuum test unit shall be comprised of the following:

- A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
- A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;
- A rubber pressure/vacuum hose with fittings and connections;
- A plastic bucket and wide paint brush;
- A soapy solution.

- b. The vacuum test procedure shall consist of the following steps:

- clean the window gasket surfaces and check for leaks;
- Energize the vacuum pump and reduce the tank pressure to approximately 5 psi absolute;
- Wet a strip of FMC approximately 12 in. by 48 in. (length of box) with the soapy solution;
- Place the box over the wetted area and compress;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;

- For a period of not less than 15 seconds from the time the vacuum gauge registers the required vacuum, examine the FMC through the viewing window for the presence of soap bubbles;
- If no bubble(s) appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 2 in. overlap and repeat the process;
- All areas where soap bubbles appear shall be marked, repaired and retested.

2. Air Pressure Test

- a. The air pressure test unit shall be comprised of the following:
 - An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining the required pressure;
 - A rubber hose with fittings and connections;
 - A sharp hollow needle, or other approved pressure feed device.
- b. The air pressure test procedure shall consist of the following steps:
 - Seal both ends of the seam to be tested;
 - Insert needle or other approved pressure feed device into the tunnel created by the wedge weld;
 - Energize the air pump to a pressure between 10 to 15 psi (30-40 mil FMC), close valve, and sustain pressure for approximately 3 minutes after equilibrium is achieved.
 - If loss of pressure exceeds 3 psi or does not stabilize, locate faulty area and repair.
 - At the conclusion of the pressure test, cut the end of the seam opposite the pressure gauge. A decrease in gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated until the blockage is corrected.

• Remove needle or other approved pressure feed device and seal.

G. Repair of Seam Failures

1. Any seam failing a nondestructive or destructive test shall be reconstructed between the failed location and any passed test location. Seam reconstruction shall be achieved by cutting out the existing seam and seaming in a replacement strip or adding a cap strip. In lieu of this, the seaming path shall be retraced to an intermediate location (at 10 feet minimum each side of the failed seam location). At each location a minimum 12 inch by 12 inch size sample shall be taken for two additional bonded seam strength tests and two additional peel adhesion tests using an approved field tensiometer. If these tests pass, then the remaining sample portion shall be sent to the independent laboratory for two bonded seam strength and two peel adhesion tests. If the field or laboratory tests pass, then the seam shall be reconstructed between that location and the original failed location. If these tests fail, then the process shall be repeated. After reconstruction, the entire reconstructed seam shall be non-destructively tested. In any case, all acceptable seams shall be bounded by two passed test locations. Certified test results on all repaired seams shall be submitted by the Contractor.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE FOR FMC

- A. Prior to installation of the FMC, all vegetation, rocks, debris, etc. and other deleterious materials, shall be removed from the surfaces to be covered with the FMC. Any roots 1/2 inch or over in diameter shall be removed to at least 18 inches below the surface. Any depressions, potholes, ruts, etc., in the surfaces to be covered shall be filled with the appropriate soil material and compacted to final grade. The finished surface shall be smooth with no abrupt projections to damage the FMC. The subgrade surface shall be observed daily by the Inspector, Contractor, and Engineer to evaluate the surface condition. No cracks in the soil barrier layer shall be present prior to placement of the FMC. Any damage to the subgrade caused by the contractor's or installer's operations shall be repaired at no additional cost to the State. No FMC or other geosynthetic material shall be placed on a subgrade that has become softened by water or overly dried, as determined by the Inspector and approved by the Engineer/Construction Manager, until it has been properly reconditioned and/or recompacted.
- B. The anchor trench shall be excavated to the line, grade, and width shown on the drawings, or as recommended by the FMC manufacturer and approved by the Engineer, prior to any geomembrane placement in the area of the trench. The Inspector

shall verify that the anchor trench has been constructed in accordance with the appropriate drawing. If the anchor trench is located in a clay susceptible to desiccation, no more than the amount of trench required for the FMC to be anchored in one day shall be excavated. Slightly rounded corners shall be provided in the trench where the FMC adjoins the trench so as to avoid sharp bends in the FMC. No loose soil or rocks shall be allowed to underlie the FMC in the anchor trench. Leading edges of the trench shall be smooth and even. After placement of the geosynthetics, the trench shall be backfilled with suitable materials so as not to damage the geosynthetics. Immediately prior to FMC placement, the Inspector, Contractor and Engineer shall certify in writing that the surface on which the FMC is to be placed is acceptable. The written certification shall include the location of perimeter points referenced by coordinates.

3.02 PLACEMENT OF FMC

A. General

1. The Contractor shall furnish the services of a competent field technical installation supervisor to supervise installation of the FMC. The FMC shall be placed over the prepared surfaces to be lined in such a manner as to assure minimum handling. Any portion of FMC damaged during installation shall be removed or repaired, at the Inspector's discretion and as specified hereinafter, at no additional cost to the Engineer.

B. Panel/Roll Deployment

1. Only those panels/rolls that can be anchored/ballasted and seamed together the same day shall be deployed.
2. Any equipment used shall not damage the FMC by handling, trafficking, or other means.
3. All personnel working on the FMC shall not smoke, wear damaging shoes, or engage in other activities which could damage the FMC.
4. The method used to unroll the panels/rolls shall not cause scratches or crimps in the FMC and shall not damage the supporting soil.
5. The method used to place the panels/rolls shall minimize wrinkles (especially differential wrinkles between adjacent panels/rolls).
6. Adequate loading (e.g., sand bags) not likely to damage the FMC shall be placed to prevent uplift by wind.

7. Direct contact with the FMC shall be minimized, i.e., the FMC in traffic areas shall be protected by geotextiles, extra FMC, or other suitable materials.
8. The Contractor shall verify that FMC thickness is in conformance with the specifications. At least two thickness readings shall be taken along the edge across each panel/roll width and four along each panel/roll length. Additional readings shall be taken across the width at any point where the panel/roll has been cut. Panels/rolls whose mil thickness falls below the specified minimum value shall be rejected and replaced at no additional cost to the State.

3.03 WEATHER CONDITIONS

- A. Where weather conditions (high winds, heavy rain, etc.) are marginal for seaming, as determined by the Inspector, test seams, as described in this Section, shall be made to decide if production seaming can proceed.

3.04 VLDPE-A FIELD SEAMS

- A. All VLDPE-A field seams shall be made using wedge welding as the primary method. Extrusion welding shall only be used for patching and seaming around appurtenances.
- B. All VLDPE-A rolls/panels shall be overlapped 5 inches maximum for wedge welding and 3 inches minimum for extrusion welding.
- C. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, and foreign material.
- D. If seam overlap grinding is required, the process shall be completed according to the manufacturer's instructions and in a way that does not damage the FMC.
- E. Seams shall be oriented parallel to the line of maximum slope and with the fewest possible number of wrinkles. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of rolls/panels to be placed in anchor trenches.

3.05 FIELD SEAM TESTING

- A. Test Seams
 1. Test seams shall be made on fragment pieces of FMC to verify that seaming conditions are adequate. All test seams shall be made at a location selected by the Inspector in the area to be seamed and in contact with the subgrade.

2. Test seams shall be made at the beginning of each seaming period, at the Inspector's discretion, whenever there is a change in seaming personnel, and at least once each four hours, by each seamer and seaming equipment used that day. One sample shall be obtained from each test seam. This sample shall be at least 2 feet long by 1 foot wide with the seam centered lengthwise. Five specimens 1 inch wide shall be cut from each opposite end of the sample by the installer using the appropriate ASTM cutting tool. These specimens shall be field tested by the Contractor for bonded seam strength and peel adhesion using an approved quantitative tensiometer. If the field tests fail to meet the minimum specified seam requirements, the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted or used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved.

3.06 DEFECTS AND REPAIRS

- A. Prior to covering the FMC, all seams and non-seam areas shall be visually inspected by the Inspector for defects, holes, damage due to windlift and any sign of contamination by foreign material. At the inspector's discretion, the surface of the FMC shall be brushed, blown, or washed by the Installer if the amount of dust or mud inhibits inspection.
- B. Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate. Each location that fails the non-destructive testing shall be marked and documented by the Inspector and repaired by the installer.
- C. Defective seams shall be repaired in accordance with this Section. Tears, holes, blisters and areas with undispersed raw materials or foreign material contamination shall be repaired by patches. Patches shall have rounded corners, be made of the same FMC, and extend a minimum of 6 inches beyond the edge of defects. All repairs shall be non-destructively vacuum tested, except where the Inspector elects to perform a destructive seam test on a suspect area.

3.07 FMC PENETRATIONS

- A. All FMC penetration details shall be as shown on the drawings or recommended by the FMC manufacturer, and as approved by the Engineer/Construction Manager. Any tailored area seams that cannot be non-destructively tested shall be cap stripped and visually inspected.

3.08 CAP SYSTEM COMPLETION

- A. Upon completion and acceptance of the FMC in an area, the FMC shall be covered with the required materials within 7 days as shown on the drawings and as described in the specifications.

B. Cover Soil

1. Cover soils shall be placed to the limits shown on the drawings and as described herein. The cover soils shall include the drainage layer as described in 02292, the vegetative layer as described in 02293, and the topsoil layer as described in 02980.
2. The Contractor shall demonstrate that his cover soil placement method will not damage the underlying geosynthetics. The Contractor shall have the option to demonstrate his placement method over a portion of the completed FMC or over a separate test section outside the limits of the cap. Construction of the test section shall incorporate the same cap materials, equipment, and procedures proposed for the full scale cap system. In either case the demonstration area shall be a minimum of four times wider than the widest piece of construction equipment proposed. The demonstration area shall be long enough to allow construction equipment to achieve normal operating speed over a minimum 25 foot length. The demonstration area shall be constructed on a surface having a slope equal to the maximum slope required for the full scale cap in areas where the FMC is to be installed. After placement of the cover soil to the specified design depth over this area, the Contractor shall remove a 20 foot by 20 foot section of the cover soils, FMC and geotextile near the center of the demonstration area. The geotextile and FMC in this area shall be visually inspected by the Inspector for damage due to placement. At the Inspector's discretion, any suspect areas of the FMC shall be non-destructively tested. Any detrimental puncturing of the geotextile and/or FMC resulting from the Contractor's placement method, as determined by the Inspector, will result in rejection of the Contractor's placement method. Full scale cover soil placement shall not commence until the placement method is approved by the Inspector and Engineer and all failed demonstration areas within the limits of the full scale cap are repaired.

- END OF SECTION -

SECTION 02296
GEOTEXTILES USED AS FILTER FABRICS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Furnishing of all plant, labor, material, and equipment and performing all operations required for furnishing, hauling, and placing geotextile, utilized in the cover system and elsewhere complete as specified herein and as shown on the drawings or specified by the Engineer.

B. Related Work Specified Elsewhere

1. Soil Barrier Layer - Section 02290.
2. Soil Barrier Layer with Bentonite - Section 02291.
3. Drainage Layer - Section 02292.
4. Vegetative Layer - Section 02293.

1.02 TESTING

- A. All geotextile testing services as specified herein necessary for the Contractor to obtain an approved geotextile material and thread shall be provided by the Contractor. All testing including laboratory and field services required during installation of the geotextile shall be provided by the Contractor.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM).

- | | |
|----------------|---|
| ASTM D 3776-85 | Test Methods for Mass Per Unit Area (Weight) of Woven Fabric |
| ASTM D 3786-87 | Test Methods for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric-Diaphragm Bursting Strength Tester Method |
| ASTM D 3787-89 | Test Methods for Bursting Strength of Knitted Goods-Constant--Rate-of-Traverse (CRT) Ball Burst Test |

ASTM D 4355-84	Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4439-87	Terminology for Geotextiles
ASTM D 4491-89	Test Methods for Water Permeability of Geotextile by the Permittivity Method
ASTM D 4884-89	Seam Strength of Sewn Geotextiles
ASTM D 4533-85	Test Methods for Trapezoid Tearing Strength of Geotextiles
ASTM D 4595-86	Tensile Properties of Geotextiles by the Wide Width Strip Method
ASTM D 4632-86	Test Methods for Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 4751-87	Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D 4833-88	Puncture
ASTM D 4884-89	Test Method for Seam Strength of Sewn Geotextiles

1.04 SUBMITTALS

- A. Manufacturer's certification of the geotextile indicating that the geotextile meets the chemical, physical, and manufacturing requirements stated in this Section.

PART 2 - PRODUCTS

2.01 GEOTEXTILE FILTER FABRIC

- A. The geotextile filter fabric shall consist of a long-chain geosynthetic polymer composed of at least 85 percent by weight of propylene, ethylene, ester, amids, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic if necessary to make the filaments resistant to deterioration due to ultra-violet and heat exposure.
- B. The geotextile shall be a non-woven pervious sheet of plastic yarn and shall provide an Apparent Opening Size (AOS).
- C. The geotextile shall have a minimum mass of 12 oz/yd² as determined by ASTM D 3776-85.

certification of the material shall be submitted by the Contractor to the Engineer. Additional testing requested by the Engineer shall be performed by the Contractor at no additional cost to the State.

2.04 BENTONITE

A. Specified Material

1. The bentonite material shall be Saline Seal 100 as manufactured by American Colloid Company or M-179 as manufactured by DOW Chemical Company, Dowell Division.

PART 3 - EXECUTION

3.01 WELL INSTALLATION

A. General

1. Materials delivery, storage and handling
 - a. All PVC riser pipe and well screens supplied under this Contract shall be shipped, stored and handled in accordance with the recommendations of the manufacturer.
2. Materials Inspection
 - a. Prior to well installation, all PVC riser pipe, well screens, and granular material shall be inspected by the Contractor in the presence of the Engineer for conformance with the standards and specifications.
 - b. All materials not meeting the requirements of the applicable specifications will be rejected.

B. Borehole Drilling

1. The Contractor shall drill the extraction wells at the locations shown in the Contract Drawings. The Contractor shall drill all the perimeter gas extraction wells to the top of the ground water table excluding lenses of perched ground water as determined by the Engineer. The Contractor shall drill the landfill gas extraction wells to the top of the ground water table or two thirds of the refuse depth table depending on which is encountered first in the drilling. The total depth of boring shall be determined at the sole discretion of the Engineer/Construction Manager.
2. The Contractor shall use hollow stem augers, or casing with a minimum inside diameter of 24 inches or other equipment approved by the Engineer to drill the borehole. No drilling mud will be used during drilling.

3. The Contractor shall bury the cuttings under the landfill cap on site in a manner approved by the Engineer.

C. Installation

1. The gas extraction wells shall be constructed as shown in the Contract Drawings.
2. The annular space surrounding the well screen to an elevation one (1) foot above the top of the screen shall be filled with the specified granular backfill.
3. The annular space surrounding the well casing from the elevation of the granular backfill to an elevation 2 feet above the granular backfill shall be filled with a bentonite slurry. The bentonite slurry shall be composed of the specified bentonite mixed with clean off-site water to a slurry consistency approved by the Engineer.

3.02 ACCEPTANCE

- A. If at any time during the installation of the gas extraction wells the Engineer determines that the well has not been installed to the standards of this Section, the Contractor will abandon the hole, backfill it as directed by the Engineer and initiate construction of a new well at a location determined by the Engineer at no cost to the Owner.
- B. Upon completion of the well, the Contractor shall demonstrate to the Engineer that the full depth of the extraction well is free from any obstructions and clear of any formation materials and that the well will allow free movement of air from the surrounding formation when a vacuum is applied to the well, or the well will be deemed unacceptable and will be abandoned as discussed in A. above.

3.03 RECORDS

- A. The Contractor will provide the Engineer with a typed, legible copy of a log for the well as follows:
 1. A record of the soil materials penetrated and the depth to which they were encountered.
 2. A record showing lengths of each diameter of casing and screen used and the location of packers, plugs and seals.
 3. Static groundwater level encountered during well installation shall be measured no sooner than 24 hours after well installation.

- END OF SECTION -

SECTION 02502
RESTORATION OF SURFACES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All types of surfaces, pavements, sidewalks, curbs, gutters, culverts and other features disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the Contract, shall be restored and maintained, as specified herein or as modified or described in the Contract Documents.
2. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

B. Related Work Specified Elsewhere

1. Environmental Protection: Section 01120
2. Earthwork: Section 02220
3. Structural Excavation, Backfill and Compaction: Section 02224
4. Trenching, Backfilling, and Compacting: Section 02226
5. Topsoil and Seeding: Section 02980
6. Embankment: Section 02222
7. Bituminous Concrete Pavement: Section 02510

1.02 SCHEDULE OF RESTORATION

- A. A schedule of restoration operations shall be submitted by the Contractor for review.
- B. In general, permanent restoration of surfaces will not be permitted until one month's time has elapsed after excavations have been completely backfilled as specified. A greater length of time, but not more than nine months may be allowed to elapse before permanent restoration of street surfaces is undertaken, if additional time is required for shrinkage and settlement of the backfill.
- C. The replacement of surfaces at anytime, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM).

ASTM D 1557-78 Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb Rammer and 18-in.

B. NJDOT Standard Specifications for pavement specifications.

1.04 SUBMITTALS

A. Preconstruction Survey of public off-site haul routes prepared in accordance with the requirements listed in Section 01120, subsection 2.02 Preconstruction Survey.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bituminous Concrete Products

1. Bituminous concrete for pavement shall conform to the New Jersey Department of Transportation Standard Specifications, Section 304 - Bituminous Stabilized Base Course and Section 404 - Bituminous Concrete Surface Course.

2. Bituminous materials shall be in accordance with NJDOT standard specifications Section 901, 903 and 904.

Base Course: NJDOT - Mix I-1, Table 903-1
Binder Course: NJDOT - Mix I-4, Table 903-1
Surface Course: NJDOT - Mix I-3, Table 903-1

PART 3 EXECUTION

3.01 TEMPORARY PAVEMENT

A. Immediately upon completion of refilling of the trench or excavation, the Contractor shall place a temporary pavement over all disturbed areas of streets, driveways, sidewalks, and other travelled places where the original surface has been disturbed as a result of his operations.

B. Unless otherwise specified or directed, the temporary pavement shall consist of Cold Mix Bituminous Pavement, in conformance with State Standards to such a depth as required to withstand the traffic to which it will be subjected.

C. For dust prevention, the Contractor shall treat all surfaces, not covered with cold patch, as frequently as may be required.

D. The temporary pavement shall be maintained by the Contractor in a safe and satisfactory condition until such time as the permanent paving is completed. The Contractor shall immediately remove and restore all pavements as they become unsatisfactory.

3.02 PERMANENT PAVEMENT REPLACEMENT

- A. The permanent and final repaving of all streets, driveways and similar surfaces where pavement has been removed, disturbed, settled or damaged by or as a result of performance of the Contract shall be repaired and replaced by the Contractor, by a new and similar pavement.
 - 1. The top surface shall conform with the grade of existing adjacent pavement and the entire replacement shall meet the NJDOT Standard Specifications for the particular types of pavement.

3.03 PREPARATION FOR PERMANENT PAVEMENT

- A. When scheduled and within the time specified, the temporary pavement shall be removed and a base prepared, at the depth required by the NJDOT, to receive the permanent pavement.
 - 1. The base shall be brought to the required grade and cross-section and thoroughly compacted before placing the permanent pavement.
 - 2. Any base material which has become unstable for any reason shall be removed and replaced with compacted base materials.
- B. Prior to placing the permanent pavement all service boxes, manhole frames and covers and similar structures within the area shall be adjusted to the established grade and cross-section.
- C. The edges of existing asphalt pavement shall be cut a minimum of one foot beyond the excavation or disturbed base whichever is greater.
 - 1. All cuts shall be parallel or perpendicular to the centerline of the street.

3.04 ASPHALT PAVEMENT

- A. The permanent asphalt pavement replacement for streets, driveways and parking area surfaces shall be replaced with bituminous materials of the same depth and kind as the existing unless otherwise specified.
- B. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of the existing pavement and other features.
- C. The furnishing, handling and compaction of all bituminous materials shall be in accordance with the New Jersey Department of Transportation Standards.

3.05 CONCRETE PAVEMENT AND PAVEMENT BASE

- A. Concrete pavements and concrete bases for asphalt, brick or other pavement surfaces shall be replaced with 4000 psi minimum 28 day strength concrete, air-entrained.
- B. Paving slabs or concrete bases shall be constructed to extend one foot beyond each side of the trench and be supported on undisturbed soil. Where such extension of the pavement will leave less than two feet of original pavement slab or base, the repair of the pavement slab or base shall be extended to replace the slab to the original edge of the pavement or base unless otherwise indicated on the Contract Drawings.
- C. Where the edge of the pavement slab or concrete base slab falls within the excavation, the excavation shall be backfilled with Special Backfill compacted to 95% maximum dry density as determined by ASTM D1557-78 up to the base of the concrete.
- D. The new concrete shall be of the same thickness as the slab being replaced and shall contain reinforcement equal to the old pavement.
 - 1. New concrete shall be placed and cured in accordance with the applicable provisions of the New Jersey Department of Transportation Standards.

3.06 STONE OR GRAVEL PAVEMENT

- A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.
 - 1. The depth of the stone or gravel shall be at least equal to the existing.
 - 2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.07 CONCRETE WALKS, CURBS AND GUTTER REPLACEMENT

- A. Concrete walks, curbs and gutters removed or damaged in connection with or as a result of the construction operations shall be replaced with new construction.
 - 1. The minimum replacement will be a flag or block of sidewalk and five feet of curb or gutter.
- B. Walks shall be constructed of 4000 psi minimum 28 day strength concrete, air-entrained with an approved stone aggregate on a 4-inch base of compacted gravel or stone.
 - 1. The walk shall not be less than 4 inches in thickness or the thickness of the replaced walk where greater than 4 inches, shall have construction joints spaced not more

than 25 feet apart and shall be sloped at right angles to the longitudinal centerline approximately 1/8 inch per foot of width.

- C. One-half inch expansion joint material shall be placed around all objects within the sidewalk area as well as objects to which the new concrete will abut, such as valve boxes, manhole frames, curbs, buildings and others.
- D. Walks shall be hand-floated and broom-finished, edged and grooved at construction joints and at intermediate intervals matching those intervals of the walk being replaced.
 - 1. The intermediate grooves shall be scored a minimum of 1/4 of the depth of the walk.
 - 2. The lengths of blocks formed by the grooving tool, and distances between construction and expansion joints shall be uniform throughout the length of the walk in any one location.
- E. The minimum length of curb or gutter to be left in place or replaced shall be 5 feet. Where a full section is not being replaced, the existing curb or gutter shall be saw cut to provide a true edge.
 - 1. The restored curb or gutter shall be the same shape, thickness and finish as being replaced and shall be built of the same concrete and have construction and expansion joints as stated above for sidewalks.
- F. All concrete shall be placed and cured as specified in the Section for concrete.

3.08 LAWNS AND IMPROVED AREAS BEYOND LANDFILL LIMITS

- A. The area to receive topsoil shall be graded to a depth of not less than 6 inches or as specified, below the proposed finished surface.
 - 1. If the depth of existing topsoil prior to construction was greater than 6 inches, topsoil shall be replaced to that depth.
- B. The furnishing and placing of topsoil, seed and mulch shall be in accordance with the Section entitled "Topsoil and Seeding".
- C. When required to obtain germination, the seeding areas shall be watered in such a manner as to prevent washing out of the seed.
- D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.
- E. The Contractor shall maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.09 CULTIVATED AREA REPLACEMENT

- A. Areas of cultivated lands shall be graded to a depth to receive topsoil of not less than the depth of the topsoil before being disturbed. All debris and inorganic material shall be removed prior to the placing of the topsoil.
- B. The furnishing and placing of topsoil shall be in accordance with the Section entitled "Topsoil and Seeding".
- C. After the topsoil has been placed and graded, the entire area disturbed during construction shall be cultivated to a minimum depth of 12 inches with normal farm equipment.
 - 1. Any debris or inorganic materials appearing shall be removed.
 - 2. The removal of stones shall be governed by the adjacent undisturbed cultivated area.
- D. Grass areas shall be reseeded using a mixture equal to that of the area before being disturbed, unless otherwise specified.

3.10 OTHER TYPES OF RESTORATION

- A. Water courses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the water course shall be protected.
- B. Culverts destroyed or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original location and grade. When there is minor damage to a culvert and with the consent of the Engineer, a repair may be undertaken, if satisfactory results can be obtained.
- C. Should brick pavements be encountered in the work, the restoration shall restore and match original type and layout.

3.11 MAINTENANCE

- A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

- END OF SECTION -

SECTION 02510

BITUMINOUS CONCRETE PAVEMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Construction of two course bituminous concrete pavement on a prepared subbase laid to the required grade, thickness and crosssection as shown on the Contract Drawings or as specified in this Section.
2. The quality of materials and performance of the work shall be in accordance with the New Jersey State Department of Transportation (NJDOT) Standard Specifications unless otherwise specified in this Section.

B. Related Work Specified Elsewhere

1. Select Fill: Section 02230
2. Restoration of Surfaces: Section 02502

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publication listed below forms a part of the specifications to the extent referenced. The publication is referred to in the text by basis designation only.

- ###### A. New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction

1.03 SUBMITTALS

- ###### A. Manufacturer's certifications that materials are in accordance with the requirements of this Section.
- ###### B. Job mix formula for each mixture shall be submitted; naming the source of each component and a report showing the results of the applicable tests as per NJDOT standard specification; Section 903.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bituminous Concrete Products

1. Bituminous concrete for pavement shall conform to the New Jersey Department of Transportation Standard Specifications, Section 304 - Bituminous Stabilized Base Course and Section 404 - Bituminous Concrete Surface Course.

2. Bituminous materials shall in accordance with NJDOT standard specifications Section 901, 903 and 904.

Base Course: NJDOT - Mix I-1, Table 903-1

Binder Course: NJDOT - Mix I-4, Table 903-1

Surface Course: NJDOT - Mix I-3, Table 903-1

PART 3 - EXECUTION

3.01 INSTALLATION

A. Subgrade

1. The subgrade shall be shaped to line and grade and compacted with self-propelled rollers.
2. All depressions which develop under rolling shall be filled with acceptable material and the area re-rolled.
3. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
4. Should the subgrade become rutted or displaced prior to the placing of the subbase it shall be reworked to bring to line and grade.

B. Subbase

1. The subbase shall consist of 12 inches of Type I-5 gradation aggregate material.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

C. Bituminous Material

1. The bituminous base course shall be 3" compacted depth.
2. The bituminous binder course shall be 1½" compacted depth.
3. The bituminous surface course shall be 1½" compacted depth.
4. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of existing pavement, curbing, gutters, manholes and other structures.

D. Testing

1. The finish pavement shall be to the grades and cross-section as shown on the Contract Drawings.
 - a. The surface tolerance shall not exceed 1/4 inch in 10 feet.
 - b. There shall be no depressions which will retain standing water.
2. Variations exceeding 1/4 inch or depressions shall be satisfactorily corrected.

- END OF SECTION -

SECTION 02600
PIPELINE INSTALLATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All metallic and non-metallic pipe, fittings and specials of the type and quality as shown on the Contract Drawings and as specified for the pipe.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling and Compacting: Section 02226
2. Select Fill: Section 02230
3. Section pertinent to the type of pipe to be installed
4. Leakage Tests: Section 02602

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

A. Not Used.

1.03 SUBMITTALS

- A. Test reports, certifications, shop drawings and samples are required as set forth in the sub-section entitled "Submittals" for the type of pipe to be installed.
- B. Layout drawings are required for pipelines to be installed within structures showing the location including the support system, sleeves and appurtenances. Layout drawings are also required for all outside piping showing location, joints and centerline elevations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe

1. Materials for the piping, joints and fittings shall be as specified in the Section for the type of pipe to be installed, shown in the pipe schedule or on the Contract Drawings.
 - a. Pipe and appurtenances shall comply with the applicable standards for its type of material.

B. Joints

1. Type of joints shall be as specified in the pipe schedule of the section entitled Pipeline Installation or as shown or noted on the Contract Drawings.
2. Grooved and shoulder type joints of the rigid design may be used in lieu of flanged joints on ductile iron or steel pipe with the prior acceptance of the Engineer.

C. Inspection

1. Pipe and appurtenances shall be inspected by the Contractor in the presence of the Engineer on delivery and prior to installation for conformance with the standards and specifications.
 - a. Materials not conforming to the standards and specifications shall not be stored on site but removed at once and replaced with material conforming to the specifications.

PART 3 - EXECUTION

3.01 INSTALLATION-UNDERGROUND

A. General

1. Excavation and backfilling shall be in accordance with the applicable provisions of the Section entitled "Trenching, Backfilling and Compacting".
2. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.
3. No pipe shall be laid upon a foundation in which frost exists; nor at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
4. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.
5. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.

B. Location and Grade

1. Pipelines and appurtenances shall be located as shown on the Contract Drawings.
2. The alignment and grades shall be determined and maintained by a method acceptable to the Engineer.

C. Joints

1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer's recommendations.

D. Embedment and Special Backfill Requirements

1. Embedment and special backfill as required shall be deposited and compacted in accordance with the Section entitled "Trenching, Backfilling and Compacting", and the Section for the type of pipe being installed and shall be one of the embedments shown below unless otherwise specified or directed.

2. Type "A" Embedment

Pipe of	Asbestos Cement
	Cast Iron Soil
	Copper
	Corrugated Steel
	Ductile Iron
	Reinforced Concrete
	Prestressed Concrete
	Vitrified Clay
	Wrought Steel

- a. The embedment shall be native material excavated from the trench, which is acceptable to the Engineer, containing no stones larger than 1-1/2 inches in size or debris.
- b. It shall be deposited and tamped in 6-inch layers to the centerline of the pipe.
- c. Native material placed above the centerline of the pipe to a depth of 12 inches above the pipe shall be deposited in such manner as to not damage the pipe.
- d. When specified or directed, Selected Fill material shall be used in lieu of the native material for a or c above.

3. Type "B" Embedment

Pressure and Non-Pressure Pipe of	Fiberglass
	Polyvinyl Chloride
	Steel
	Thermal Plastic
	Stainless Steel
	Polyethylene

1. It shall be deposited and hand-compacted in 6-inch maximum layers.

4. Type "C" Embedment

Non-pressure perforated pipe of	Polyvinyl chloride
	Fiberglass
	Thermal Plastic

1. It shall be deposited and hand-compacted in 6-inch maximum layers.

E. Thrust Restraints

1. Pressure pipelines shall have thrust restraints in the form of thrust blocks, tie rods, or anchors of the size and type specified or as required by the pressure and stability of the supporting surface.

- a. Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown.
- b. Thrust restraints shall be in place, and when of concrete 3,000 psi minimum 28 day strength, shall have developed the required strength, prior to testing of the pipeline.
- c. Tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.
 1. Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.

F. Service Connections

1. Connections to in-service pressure pipelines shall be in accordance with the applicable provisions of the Specifications.
2. Laterals of the kind and size of pipe as required to match existing pipe shall be installed as shown, specified or directed.
 - a. Bends, as required, shall be used between the connection and the lateral, to obtain the correct slope and to allow the horizontal angle of the lateral to be at 90 degrees to the main line or other angle as specified or directed.
 - b. Minimum slope for a lateral shall be 1/4 inch per foot.
 - c. Maximum slope for a lateral shall be 2 feet per foot unless otherwise specified.
 - d. Each lateral having a slope of 1 foot per foot or greater shall have a concrete cradle as shown in the Contract Documents.
 - e. Laterals specified to exceed the maximum slope shall be supported to prevent excessive load being applied to the main line pipe and shall be encased in a minimum of 6 inches of 3,000 psi minimum 28 days strength concrete.
3. Connections and ends of laterals shall not be backfilled until a record has been made of the "as-built" location of each.

G. Connection to Existing Structures or Manholes

1. Where a stub has been provided the connection shall be made to the existing pipe.
2. Where no stub has been provided, the Contractor shall make an opening for inserting the connecting pipe.
 - a. When specified, a sleeve shall be installed and a watertight joint formed.
 - 1) The carrier pipe shall be installed in the sleeve and the joint made watertight.
 - b. Where no sleeve is specified, the space between the pipe and the wall of the structure or manhole shall be made watertight.
 - c. A joint shall be in the pipe at or within 5 feet of a structure or manhole.
 - d. A channel shall be built or the existing channel revised, to direct the flow from or into the new pipe.
 - e. Care shall be taken to avoid damage to the existing structure or manhole and to prevent debris from entering any existing channel. Any damage shall be repaired and debris removed.

3.02 INSTALLATION - EXPOSED

- A. Exposed pipelines shall be carefully erected and neatly arranged.
 1. Run parallel to wall of structures.
- B. Supports and anchors shall be adequate to support the pipe filled with water with a minimum safety factor of 5 and for the test pressure specified.
- C. Special supports shall be as specified in the Section for the type of pipe being installed.
- D. Pre-insulated, pre-heat traced tubing shall be installed according to manufacturers instructions.

3.03 FINAL INSPECTION OF GRAVITY PIPE

- A. Each section of pipe between manholes shall be inspected before final acceptance.
 1. In larger pipelines the inspection shall be by traversing the inside of the pipe.

2. In smaller pipelines the inspection shall be by observation with illumination.
- B. The inspection shall determine the pipeline to be true to line and grade, to show no leaks, to have no obstruction to flow, to have no projections or protruding of connecting pipes or joint materials, shall be free from cracks and shall contain no deposits of sand, dirt or other materials.
- C. All deficiencies located during the inspection shall be corrected.

3.04 CUTTING AND SPECIAL HANDLING

- A. Field cuts of pipes shall be in accordance with the manufacturer's instructions.
- B. Where a pipe requires special handling or installation it shall be in accordance with the Section for that type of pipe.

3.05 WALL CASTINGS AND SLEEVES

1. All pipelines passing through walls, floors or slabs of structures shall be installed in a wall casting or sleeve. The wall castings and sleeves shall be in accordance with the Section entitled "Wall Castings and Sleeves".

3.06 LEAKAGE TEST

- A. All pipelines shall be tested for leakage in accordance with the Section entitled "Leakage Tests".
- B. Pipelines carrying condensate or leachate shall have zero leakage.

3.07 PROTECTION AGAINST CORROSION

1. When dissimilar metals are joined, an insulating coupling or fitting shall be used.

3.08 SCHEDULE OF INSIDE PROCESS PIPING

<u>Designation</u>	<u>Name</u>	<u>Diameter</u>	<u>Type of Pipe</u>	<u>Thickness or Class</u>	<u>Type of Joint</u>	<u>Type of Fitting</u>	<u>Coating Interior</u>	<u>Exterior</u>	<u>Test Pressure psi</u>
GW	Ground water	2"-3"	PVC	Sch 80	SW	PVC	--	--	50
GW	Ground water	>3	FRP	3"-.075" 4"-.095" 6"-.123"	SW	FRP	--	--	50
LGC	Landfill Gas Condensate	1/2"-2"	PVC	Sch 80	SW	PVC	--	--	50
NaOH	Sodium Hydroxide	<1"	PVC	Sch 80	SW	PVC	--	--	100
FES	Ferric Sulfate	<2"	PVC	Sch 80	SW	PVC	--	--	100
PPOL	Process Polymer	<1"	PVC	Sch 80	SW	PVC	--	--	100
PHAC	Phosphoric Acid discharge	<1"	PVC	Sch 80	SW	PVC	--	--	100
AOH	Ammonium Hydroxide discharge	<1"	PVC	Sch 80	SW	PVC	--	--	100
SAC	Sulfuric Acid discharge	<1"	PVC	Sch 80	SW	PVC	--	--	100
PHAC	Phosphoric Acid Suction	<1/2"	Tygon	--	--	--	--	--	100
AOH	Ammonia Hydroxide	<1/2"	Tygon	--	--	--	--	--	100
SAC	Sulfuric Acid Suction	<1/2"	"	--	--	--	--	--	100
PAC	Powdered Activated Carbon Slurry	1/2-3"	30455	Sch 10	W	304SS	--	--	100
DE	Diatomaceous Earth Slurry	1-3"	PVC	Sch 80	SW	PVC	--	--	100
SPOL	Sludge System Polymer	<1"	PVC	Sch 80	SW	PVC	--	--	100
AH	High Pressure Air	1/2-2"	CS	Sch 40	W	CS	--	PT	150
AL	Low Pressure Air	3-6"	CS	Sch 40	W	CS	-	PT	20
SLDG	Sludge	<2 1/2"	PVC	Sch 80	SW	PVC	--	--	200
SLDG	Sludge	3"	FRP	0.123"	SW	FRP	--	--	50
PLW	Plant Water	≤ 3"	Cu	L	Sold	Cu	--	INS	150
OVRFL	Overflows	≤ 3"	PVC	Sch 40	SW	PVC	--	--	grav
DR	Drain	≤ 3'"	PVC	Sch 40	SW	PVC	--	--	grav

<u>Designation</u>	<u>Name</u>	<u>Diameter</u>	<u>Type of Pipe</u>	<u>Thickness or Class</u>	<u>Type of Joint</u>	<u>Type of Fitting</u>	<u>Coating Interior</u>	<u>Exterior</u>	<u>Test Pressure psi</u>
CBWI	Carbon Backwash Influent	≤ 6"	PVC	Sch 40	SW	PVC	--	--	75
CBWE	Carbon Backwash Effluent	≤ 6"	PVC	Sch 40	SW	PVC	--	--	75
CBS	Carbon Slurry	4"	PPLS	Sch 40	Flg	PPLS	--	PT	150
LG	Landfill Gas	≤10"	CS	Sch 40	Flg	CS	Epox	P	50

3.09 SCHEDULE OF OUTSIDE PIPING

<u>Designation</u>	<u>Name</u>	<u>Diameter</u>	<u>Type of Pipe</u>	<u>Thickness or Class</u>	<u>Type of Joint</u>	<u>Type of Fitting</u>	<u>Coating Interior</u>	<u>Exterior</u>	<u>Test Pressure psi</u>
GW	Ground water (buried)	8"	HDPE	SDR21	BF	HDPE	--	--	75
GW	Ground water (buried)	3-6"							
GW	Ground water (exposed)	8"	CS	Sch 40	W	CS	--	INS/HT/J	75
GW	Ground water (exposed)	3-6"	FRP	0.20"	SW	FRP	--	INS/HT/J	50
LGC	Landfill Gas Condensate (buried)	≤ 3"	HDPE	SDR21	BF	HDPE	--	--	75
LGC	Landfill Gas Condensate (exposed)	≤ 3"	FRP	3"-0.75"	SW	FRP	--	INS/HT/J	75
DR	Drains (plant site)	4-8"	DI	50	PO	DI	CT	CT	grav
OVRFL	Tank Overflow (exposed)	4-6"	CS	Sch 40	W	CS	--	PT	grav
GW	Plant Outfall Sewer	6"	DI	Class 50	PO	DI	--	--	grav
GW bypass	Ground Water Bypass	6"	DI	Class 50	PO	DI	--	--	grav
SLDG	Sludge	3-6"	FRP	0.20"	SW	FRP	--	INS/HT/J	50
AL	Low Pressure Air	3-6"	CS	Sch 40	CS	W	--	P	20
LG	Landfill Gas (buried)	4-8"	PVC	Sch 40	SW	PVC	--	--	50
LG	Landfill Gas (exposed)	10"	CS	Sch 40	CS	W	epox	P	50
LG	Landfill Gas (exposed)	4-8"	FRP	4" - .095" 6" - .123" 8" - .140"	Thrd	FRP	--		50
N/GAS	Natural Gas	≤ 2"	CS	Sch 40	Thrd	CS	--	P	--
CBWI	Carbon Backwash Influent	6"	PVC	Sch 80	SW	PVC	--	--	75
CBWE	Carbon Backwash Effluent	6"	CS	Sch 40	W	CS	-	P	75
CBS	Carbon Slurry	4"	PPLS	Sch 40	Flg	PPLS	--	PT	150
AH	High Pressure Air	1/2"-2"	CS	Sch 40	W	CS	--	PT	150
CONT	Containment Pipe	6"	CS	Sch 40	W	CS	--	INS/HT/J	grav
NaOH	Sodium Hydroxide	1/4	TT	--	--	--	--	PRE-INS/HT	100

<u>Designation</u>	<u>Name</u>	<u>Diameter</u>	<u>Type of Pipe</u>	<u>Thickness or Class</u>	<u>Type of Joint</u>	<u>Type of Fitting</u>	<u>Coating Interior</u>	<u>Exterior</u>	<u>Test Pressure psi</u>
POTW	Potable (City) Water	--	DI	Class 50	PO	DI	CL	CT	150
RCR	Reinforced Concrete Pipe	12-48"	RCP	V	PO	--	--	--	--
DR	Drainage (Landfill)	≤ 6"	PVC	Sch 40	SW	PVC	-	-	-

Abbreviations

DI	Ductile Iron Pipe
Cu	Copper
Epoxy	Epoxy
FRP	Fiberglass Reinforced Plastic
HDPE	High Density Polyethylene
PPLS	Polypropylene lined steel
Sold	Soldered
MJ	Mechanical Joint
CL	Cement Lined
CT	Coal Tar
CS	Carbon Steel
PO	Push-On
RS	Rubber and Steel
SS	Stainless Steel
W	Welded
SW	Solvent Welded
PVC	Polyvinyl Chloride
TD	Threaded
Fla	Flanged
Galv	Galvanized
Sch	Schedule
P	Painted
Ins	Insulated
CPVC	Chlorinated Polyvinyl Chloride
HT	Heat Traced
J	Jacketed

SECTION 02602

LEAKAGE TESTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Testing of all hydraulic structures, pressure and non-pressure piping for leakage as specified.
 - a. The Contractor shall furnish all labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.
2. All testing shall be witnessed by the Engineer.
3. Tank leakage tests shall not be performed under this Section.

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM C828-89	Practice for low-pressure air test of vitrified clay pipe lines (4 to 12 inch).
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1.03 SUBMITTALS

A. Not used.

PART 2 - PRODUCTS

A. Not used.

PART 3 - EXECUTION

3.01 LEAKAGE TESTS FOR STRUCTURES

- A. Vaults, inlets, wells and other fluid containing structures, (excluding tanks, manholes) shall be tested before backfilling by filling the structure with water to overflowing, or other level as may be directed by the Engineer, and observing the water surface level twenty-four hours thereafter.
 1. When testing absorbent materials such as concrete, the structure shall be filled with water at least 24 hours before the test is started.

B. The exterior surface, especially at the construction joint, will be inspected for leakage during and upon completion of the twenty-four hour test.

1. Leakage will be considered to be within the allowable limits when there is no visible sign of leakage on the exterior surface and where the water surface does not drop except as associated with evaporation or absorption.
2. A slight dampness on the exterior wall surface during the test period will not be considered as leakage, except in the case of prestressed concrete structures.

3.02 TESTS ON PRESSURE PIPING FOR TRANSPORT OF CONDENSATE

A. General

1. Pipelines designed to transport leachate under pressure shall be tested hydrostatically and for leakage prior to being placed in service.
2. The length of piping and sections included in the tests shall meet the approval of the Engineer.
3. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the Contractor at his expense.
4. When piping is to be insulated or concealed in a structure, tests shall be made before the pipe is covered.
5. All fittings, hydrants and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices which will become a part of the system must also be tested at the test pressure.
6. When testing absorbent pipe materials such as asbestos cement or concrete, the pipeline shall be filled with water at least 24 hours before the test is made.
7. If the line fails the test, the Contractor shall explore for the cause of the excessive leakage and after repairs has been made the line shall be retested. This procedure shall be repeated until the pipe complies.

B. Pressure Test

1. Test pressure shall be as scheduled or, where no pressure is scheduled, at 150 psi.
2. Test pressure shall be held on the piping for a period of at least 2 hours.

C. Leakage Test

1. The leakage test shall be conducted concurrently with the pressure test.
2. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three consecutive 15 minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
 - a. At the completion of the test the pressure shall be released at the furthestmost point from the point of application.
3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating the tests.
4. The allowable leakage for pressure pipelines shall not exceed the following in gallons per 24 hours per inch of diameter per mile of pipe:

<u>Type of Pipe</u>	<u>Leakage</u>
Ductile iron	0
Asbestos-cement	20
Polyvinyl chloride, thermal plastic or fiberglass with rubber joints	10
Polyvinyl chloride, thermal plastic or fiberglass with solvent-cemented or Certa-Lok joints	0
Concrete with steel and rubber joints	10
Steel with welded joints	0
Steel with harnesses joints	10
Wrought steel	0
Copper	0
All piping inside structures	
All piping carrying condensate or ground water	0

5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

3.03 TEST FOR NON-PRESSURE PIPELINES FOR TRANSPORT OF CONDENSATE AND/OR WATER

A. General

1. Pipelines designed to carry water and/or condensate in open channel flow or at minimal pressures shall be tested for leakage prior to being placed in service.
2. The leakage shall be determined by exfiltration, infiltration or low pressure air. The testing method directed by the Engineer shall take into consideration the groundwater elevation of the section of pipe being tested.
3. Intermediate leakage tests during construction shall be made at the Contractor's discretion. Upon completion of any pipeline, the entire system including manholes shall be tested for compliance to allowable leakage.
4. When testing absorbent pipe materials such as asbestos-cement or concrete, the pipeline shall be filled with water at least 24 hours before the test is made.
5. Groundwater level shall be determined by the Contractor prior to any testing by reading the water level at the observation pipe in the manholes.
6. If the line fails the test, the Contractor shall explore for the cause of the excessive leakage and after repairs has been made the line shall be retested. This procedure shall be repeated until the pipe complies.

B. Exfiltration Testing

1. Exfiltration tests shall be made by filling a section of pipeline with water and measuring the quantity of leakage.
2. The head of water at the beginning of the test shall be at least two feet above the highest pipe within the section being tested.
 - a. Should groundwater be present within the section being tested, the head of water for the test shall be two feet above the hydraulic gradient of the groundwater.
 - b. Should the requirement of two feet of water above the highest pipe subject any joint at the lower end of the test section to a differential head of greater than 11.5 feet another method of testing shall be employed.

C. Infiltration Testing

1. Infiltration tests will be allowed only when the water table gauges determine the groundwater level to be two feet or more above the highest pipe of the section being tested.
2. Infiltration test shall be made by measuring the quantity of water leaking into a section of pipeline.
3. Measurement of the infiltration shall be by means of a calibrated weir constructed at the outlet of the section being tested.

D. Allowable Leakage for Non-Pressure Pipelines

The allowable leakage (exfiltration or infiltration) for non-pressure pipelines shall not exceed the following in gallons per 24 hours per inch of diameter per 1000 feet of pipe:

<u>Type of Pipe</u>	<u>Leakage</u>
Ductile iron - mechanical or push-on joints	10
Asbestos-cement "O" ring joints	20
Polyvinyl chloride, thermal plastic or fiberglass with rubber joints	10
Polyvinyl chloride, thermal plastic or fiberglass with solvent-cemented joints	0
Concrete with rubber joints	20
Concrete with steel and rubber joints	10
Corrugated Steel	95
Clay with rubber gasket joints	20
Cast iron soil pipe	
1. drains and vents	0
2. sewer laterals	*
Any pipeline carrying condensate or ground water	0
All piping inside structures	0

* The same allowable as pipe to which it is connected.

Regardless of the above allowable leakage any spurting leaks detected shall be permanently stopped.

E. Air Testing

1. For the acceptance of air testing in lieu of hydrostatic testing (exfiltration or infiltration), the Contractor shall perform hydrostatic and air tests on at least three sections of pipeline for each type of pipe being used.

The Engineer shall select the sections for the corroborative tests. If these dual tested sections indicate the same results, that is, acceptance under both tests, air testing will be allowed in lieu of hydrostatic testing to meet the project requirements.

2. Air testing for acceptance shall not be performed until the backfilling has been completed.
3. Low pressure air tests shall conform to ASTM C828-89 except as specified herein and shall not be limited to type or size of pipe.
4. All sections of pipelines shall be cleaned and flushed prior to testing.
5. The air test shall be based on the average holding pressure of 3 psi gauge, a drop from 3.5 to 2.5 psi, within the period of time allowed for the size of pipe and the length of the test section. The time allowed for the 1 psi drop in pressure, measured in seconds, will be computed by the Engineer and will be based on the limits of ASTM C828-89.
 - a. When groundwater is present the average test pressure of 3 psig shall be above any back pressure due to the groundwater level.
 - b. The maximum pressure allowed under any condition in air testing shall be 10 psig. The maximum groundwater level for air testing is 13 feet above the top of the pipe.
6. The equipment required for air testing shall be furnished by the Contractor and shall include the necessary compressor, valves and gauges to allow for the monitoring of the pressure, release of pressure and a separable test gauge.
 - a. The test gauge shall be sized to allow for the measuring of the one psig loss allowed during the test period and shall be on a separate line to the test section.

3.04 MANHOLE TESTING

A. General

1. Each manhole shall be tested by either exfiltration or infiltration.
2. A manhole will be acceptable if the leakage does not exceed an allowable of one gallon per vertical foot of depth for 24 hours. Regardless of the allowable leakage any leaks detected shall be permanently stopped.

SECTION 02612
REINFORCED CONCRETE NON-PRESSURE PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Reinforced concrete pipe with concrete and rubber joints or steel and rubber joints.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling and Compacting: Section 02226
2. Pipeline Installation: Section 02600
3. Leakage Tests: Section 02602

1.02 APPLICABLE CODES, STANDARD AND SPECIFICATIONS

The publications listed below form a part of the specifications to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM C76-89 Specification for reinforced concrete culvert, storm drain, and sewer pipe.

ASTM C361-89b Specification for reinforced concrete low-head pressure pipe.

ASTM C443-85a Specification for joints for circular concrete sewer and culvert pipe, using rubber gaskets.

1.03 SUBMITTALS

- A. Manufacturer's drawings and details of pipe, joints and gaskets for each size and class of pipe.
- B. The Physical Requirements test of ASTM C76-89, Section 11 shall be furnished the Engineer upon request.
- C. The manufacturer shall certify the pipe and gaskets furnished comply with all applicable provisions of ASTM and this specification.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe

1. Pipe shall conform to the requirements of ASTM C76-89a.
2. Class shall be as shown in the pipe schedule.
3. No lifting holes allowed.

B. Joints

1. Joints shall be of the type shown on the pipe schedule.
2. Concrete and rubber joints shall conform to the requirements of ASTM C443-85a.
3. Steel and rubber joints shall meet the joint requirements of ASTM C361-89b and C443-85a.
 - a. Bell and spigot pipe ends shall be steel joint rings securely fastened in the pipe wall.
 - b. Spigot ring shall have a groove for the rubber gasket.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Concrete pipe shall be installed in accordance with the requirements of the Sections entitled "Trenching, Backfilling and Compacting" and "Pipeline Installation".
- B. The maximum joint opening shall not exceed 1/2 inch at any point.
- C. After joint assembly the position of the gasket shall be checked by use of a feeler gauge, and the gasket replaced if out of position.
- D. Joints shall be sealed after installation with cement mortar grout.
 1. Exterior joints shall be firmly packed and overfilled.
 2. Interior joints of pipe 20 inches and larger shall be firmly packed and troweled smooth to the pipe section.
 3. Mortar grout shall be a 1:2 mix.

3.02 TESTING

A. Leakage tests shall be made in accordance with the applicable provisions of the Section entitled "Leakage Tests".

1. Leakage of pipe or joints shall not exceed the allowable.

- END OF SECTION -

SECTION 02620

POLYVINYL CHLORIDE NON-PRESSURE PIPE

PART 1 - GENERAL

1.01 WORK SPECIFIED

- A. Polyvinyl chloride pipe and fittings of the classification, size and type of joints as specified in the pipe schedule and shown on the Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Pipeline Installation: Section 02600
- B. Leakage Tests: Section 02602

1.03 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

- A. American Society for Testing and Materials (ASTM).

ASTM D1784-81 Specification for rigid poly (vinyl chloride) (PVC) compounds and chlorinated poly (vinyl chloride) (CPVC) compounds.

ASTM D3034-89 Specification for type PSM poly (vinyl chloride) (PVC) sewer pipe and fittings.

ASTM D3212-89 Specification for joints for drain and sewer plastic pipes using flexible elastomeric seals.

1.04 ACCEPTABLE MANUFACTURERS

- 1. Carlon
- 2. National Pipe Company
- 3. Approved Equal

1.05 SUBMITTALS

- A. Drawings and manufacturers data of the pipe, joints and fittings showing compliance with this specification.
- B. Submit five (5) copies of manufacturer's affidavit that all delivered materials comply with the requirements of the specified Standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Polyvinyl chloride pipe shall be made from Class 12454-B or 13364-A materials in accordance with ASTM D1784-81.
2. Polyvinyl chloride pipe and accessories shall conform to the requirements of ASTM D3034-89 with a minimum pipe stiffness of 320 psi at a maximum deflection of 5%:

B. Fittings and Couplings

1. Polyvinyl chloride fittings and couplings shall conform to the requirements of the PVC pipe for classification and size.

C. Joints

1. Joints shall be of the bell and spigot push on type.
2. Rubber gaskets for elastomeric joints shall conform to ASTM D-3212-89.
 - a. Lubricant for the joints shall be furnished by the pipe manufacturer.
 - b. The rubber gaskets shall be factory installed in the bell of the pipe, fittings and couplings.
3. The plain end of the pipe shall be marked by the manufacturer to show the depth of penetration into the bell or coupling.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Polyvinyl chloride pipe shall be installed in accordance with the applicable provisions of the Sections entitled "Trenching, Backfilling, and Compacting" and "Pipeline Installation".
- B. Polyvinyl chloride pipe shall be handled and stored in accordance with the manufacturer's recommendations.

3.02 TESTING

- A. Pipe deflection shall be checked by passing a deflection gauge through all completed pipelines.
 1. Maximum deflection allowed 5%.

2. The test for deflection shall be made not less than 30 days after the completion of the installation unless otherwise approved by the Engineer.
 3. Deflection gauge shall be pulled through the pipe by hand.
 4. Any section of pipe found to have a deflection in excess of 5% shall be corrected by the Contractor at his expense.
- B. Leakage tests shall be performed in accordance with the applicable provisions of the Section entitled "Leakage Tests".

- END OF SECTION -

SECTION 02621

PERFORATED POLYVINYL CHLORIDE DRAINAGE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

Work under this section shall consist of all labor, materials, supplies, and equipment necessary to furnish and install the perforated polyvinyl chloride drainage pipe as specified herein and as shown on the Contract Drawings.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: Section 02226
2. Pipeline Installation: Section 02600
3. Leakage Tests: Section 02602

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

- | | |
|---------------|--|
| ASTM F758-82 | Specification for smooth-wall poly (vinyl chloride) (PVC) plastic underdrain systems for highway, airport, and similar drainage. |
| ASTM D1784-81 | Specification for rigid poly (vinyl chloride) (PVC) compounds and chlorinated poly (vinyl chloride) (CPVC) compounds. |
| ASTM D3212-89 | Specification for joints for drain and sewer plastic pipes using flexible elastomeric seals. |

1.03 SUBMITTALS

- A. Drawings and manufacturers data of the pipe, joints, and fittings showing compliance with this specification.
- B. Submit five (5) copies of manufacturer's affidavit that all delivered materials comply with the requirements of the specified standards.

PART 2 PRODUCTS

2.01 GENERAL

- A. Perforated drain pipe and fittings shall be made of polyvinyl chloride (PVC) compound having a cell classification of Class 12454C materials or better in accordance with ASTM D 1784-81.
- B. Perforated drain pipe and accessories shall conform to the requirements of the following with a minimum pipe stiffness of the 46 psi at a maximum deflection of 5%:

ASTM F758-82 4" - 8" pipe

2.02 JOINTS

- A. Joints for perforated drainage pipe and fittings shall be of the bell and spigot push on type with flexible elastomeric seals which meet the requirements of ASTM D 3212-89.
- B. The plain end of the pipe shall be marked by the manufacturer to show the depth of penetration into the bell or coupling.
- C. Lubricant for the joints shall be furnished by the manufacturer.

2.03 PERFORATIONS

- A. Perforation shall be in accordance with ASTM F 758-82.
- B. Pipe shall be installed with perforations down.

PART 3 EXECUTION

3.01 PIPE INSTALLATION - GENERAL

- A. Pipe Delivery, Storage and Handling
 - 1. All pipe supplied under this Contract shall be shipped, stored, and handled in accordance with the recommendations of the manufacturer.
- B. Initiation of Installation
 - 1. Inspection
 - a. Prior to installation, all pipe, fittings, and specials will be inspected by the Contractor in the presence of the Engineer for conformance with the standards and specifications.
 - b. All pipe not meeting the requirements of the applicable specifications will be rejected.
 - c. The Contractor shall furnish all labor required to handle the material during inspection and shall

remove the rejected material from the site, as directed.

2. Discrepancies

- a. In the event that the inspection reveals discrepancies, the Contractor shall suspend installation.

C. Installation

1. General

- a. Polyvinyl chloride pipe shall be installed in accordance with the applicable provisions of the Sections titled "Trenching, Backfilling, and Compacting" and "Pipeline Installation" and as shown on the Contract Drawings.
- b. All pipelines in the trenches shall be laid on a flat bottom.
- c. Blocking will not be permitted under pipe.
- d. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris, or water.
- e. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.
- f. Push-on joints shall be made by guiding the plain end into the bell until contact is made with the gasket and exerting sufficient force to drive the pipe home until penetration is made to the depth recommended by the manufacturer.

D. Inspection

- 1. All non-pressure perforated PVC pipe shall be inspected and lamped after placement to insure a complete working installation. The inspection shall determine if the pipeline is true to line and grade, has obstructions to flow, or has projections or protrusions of connecting pipes or joint materials. The pipeline shall be free from cracks and shall contain no deposits of backfilled materials. Any deficiencies identified during inspection shall be corrected by the Contractor at his expense.
- 2. Pipe deflection shall be checked by passing a deflection gauge through all completed pipelines.
 - a. Maximum deflection allowed - 5%.

SECTION 02628
DUCTILE IRON PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. This section includes the material and quality requirements for Ductile Iron Pipe, fittings and EPDM gasket material.

B. Work Specified Elsewhere

1. Pipeline Installation: Section 02600
2. Leakage Tests: Section 02602

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers

1. United States Pipe and Foundry Company
2. American Cast Iron Pipe Company
3. Griffin Pipe

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

A. American Society for Testing and Materials (ASTM).

ASTM A307	Specification for Carbon Steel Bolts and Studs 60,000 psi Tensile
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B. American National Standard/American Water Works Association

ANSI/AWWA C110	Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids
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ANSI/AWWA C111	Standards for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
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ANSI/AWWA C104	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
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ANSI/AWWA C105	Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
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ANSI/AWWA C115	Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
ANSI/AWWA C151	Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C606	Standard for Grooved and Shouldered Joints

1.04 SUBMITTALS

- A. Five certified copies of the reports of the pipe and fittings test required in accordance with the provisions for testing in the applicable standards.
- B. Detailed shop drawings and data in compliance with the Section entitled "Contractor's Responsibilities" of the General Conditions.
- C. Layout drawings for Ductile Iron Pipe to be installed within structures showing the location including the support system, sleeves and appurtenances.

PART 2 PRODUCT

2.01 STANDARDS

- A. Ductile iron pipe and fittings shall comply with the following standards:

	<u>ANSI/AWWA</u>
Ductile Iron Pipe	C151
Fittings	C110
Joints - Mechanical and Push-On	C111
Joints - Flanged	C115
Cement Lining	C104
Polyethylene Encasement	C105
- B. All shipments of pipe shall be tested, at the Contractor's expense, in accordance with the provisions for testing in the applicable standards.
 1. Specimens up to 0.5 percent of the number of each size and type of pipe furnished shall be tested except in no case shall less than two specimens be tested.
 2. Testing shall be by an approved testing laboratory.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Ductile iron pipe shall be installed in accordance with the applicable provisions of the Section entitled "Pipeline Installation".
2. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.
3. Ductile iron pipe shall be installed in embedment which shall consist of materials placed in six-inch tamped layers to a depth equal to one-half the nominal diameter of the pipe. The embedment material shall be taken from the excavated material containing no stones larger than 1-1/2 inches provided such material is acceptable to the Engineer, or other materials as specified or directed.

B. Joints

1. The type of joints for ductile iron pipe and fittings shall be as scheduled on the pipe schedule and/or as shown on the Contract Drawings.
2. To insure electrical conductivity, bronze wedges, or jumpers shall be installed at each mechanical or push-on joint.
 - a. Mechanical joints shall be made up in accordance with the Notes on Method of Installation, AWWA C111, Appendix A. All bolts shall be tightened by means of torque wrenches such that the follower shall be brought up evenly. If effective sealing is not obtained at the specified torques, the joint shall be disassembled, cleaned and reassembled.
 - b. Push-on joints shall be made using lubricant furnished by the manufacturer. The joint shall be made by guiding the plain end into the bell until contact is made with the EPDM gasket and exerting sufficient force to drive the pipe home until penetration is made to the depth recommended by the manufacturer.
3. Flanged joints shall be made up with through bolts of the size required for the pipe being installed. Stud bolts shall be used only where shown or required. Connecting flanges shall be in proper alignment and no external force shall be required or used to bring them together.
 - a. Flanges for flanged joints shall be drilled for 150 psi pressure unless otherwise specified.

- 1) Flange bolts and nuts shall be steel, ASTM A307, Grade B, and shall be cadmium plated except where other materials are called for on the pipe schedule.
- b. Cadmium plating shall be a thickness of 0.0003 to 0.0005 inches.
 - 1) Gaskets shall be EPDM unless otherwise specified.
4. Grooved and shoulder type joints shall be in accordance with AWWA C606 using rigid types only.
 - a. Grooves for rigid joints shall be in accordance with Table 5 for iron pipe and Table 3 for steel pipe.
 - b. Bolts and nuts shall be cadmium plated steel.
 - c. Details of supports, anchors and couplings shall be submitted for review.

C. Coating, Painting and Lining

Coating, painting and lining shall be as follows unless otherwise specified.

1. Pipe installed in the ground, in exposed exterior locations, in contact with water or inside structure but not scheduled for painting:

<u>Interior Lining:</u>	Bituminous coating or standard thickness cement lining with sealcoat unless otherwise specified.
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<u>Exterior Lining:</u>	Bituminous coating.
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2. Pipe installed inside structure or scheduled for painting:

<u>Interior Lining:</u>	Bituminous coating or standard thickness cement lining with sealcoat unless otherwise specified.
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<u>Exterior Lining:</u>	Pipes with bituminous coatings shall be coated with Inertol "Tar Stop," or Mobil Anti-Bleeding Sealer Aluminum 13-A-1 or equal, or sandblasted as specified, before additional coats are applied.
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- END OF SECTION -

SECTION 02645

FIRE HYDRANTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included

1. Fire Hydrants installed at the locations shown on Contract Drawings or as directed.

B. Related Work Specified Elsewhere

1. Select Fill: Section 02230
2. Pipeline Installation: Section 02600
3. Gate Valves 3 Inches and Larger: Section 02603
4. Concrete for Pipelines, Vaults and Inlets: Section 03307

C. Applicable Codes, Standards and Specifications

1. American Water Works Association (AWWA)

1.02 QUALITY ASSURANCE

- ###### A.
- Conform to the requirements of AWWA C502, Dry-Barrel Fire Hydrants.

- ###### B.
- Conform to the requirements of NFPA 24.

1.03 SUBMITTALS

- ###### A.
- Drawings showing dimensions, construction, materials and parts list.

- ###### B.
- Submit manufacturer's affidavit stating that the hydrants comply with all applicable provisions of AWWA C502.

PART 2 PRODUCTS

2.01 CONSTRUCTION FEATURES

- ###### A.
- One 4-1/2 inch pumper and two 2-1/2 inch hose outlets.

1. Size and threads shall conform to the requirements of the Fire Department servicing the area of installation.

- ###### B.
- Main valve opening shall be not less than 5 inches.

- ###### C.
- Barrel length shall provide for minimum of 5 foot bury.

1. Barrel extensions to be provided as required by finish grade.
- D. Barrels shall be of the break-away type.
- E. Operating stem seal shall be "O" rings.
- F. Valves shall open counterclockwise with direction of opening cast on bonnet.
- G. Inlet shall be 6-inch mechanical joint unless otherwise specified.
- H. Finish color(s) shall be the same as other hydrants within the District.

PART 3 EXECUTION

3.01 INSTALLATION

A. Alignment

1. Hydrant shall be set plumb with pumper nozzle facing roadway.
2. Center of hydrant to center of auxiliary valve shall be minimum of 30 inches.
3. Center of pumper nozzle shall be between 15 inches and 18 inches above finish grade.
 - a. Extension barrels shall be used to achieve clearance.

B. Bracing

1. Bracing shall be:
 - a. Thrust blocks of Class C concrete behind the branch tee and hydrant, or
 - b. Harnessing together of hydrant, auxiliary valve and branch tee.

C. Drain

1. Provide drain pocket of not less than 1/2 cubic yard, Type C granular material as specified in the Section entitled Selected Fill.
2. Extend granular material above hydrant drain.
3. Cover granular material with builders felt prior to back-filling.

- END OF SECTION -

SECTION 02675

CHLORINATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. The cleaning, chlorinating and flushing of all pipelines or structures which will carry or hold potable water.
2. Permission shall be obtained from the owner of the water system before the use of water from any existing system. The Contractor shall:
 - a. Conform to the requirements of the owner.
 - b. Pay all costs connected with the taking or use of water.
 - c. Give notice at least 24 hours before the use of water for any reason.
3. All work under this section shall be performed in the presence of the Engineer and a representative of the public health authority having jurisdiction, as required.
4. Chlorination shall be scheduled such that sampling and flushing will be performed during normal daylight working hours.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Chlorination shall be by the use of a solution of water and liquid chlorine, calcium hypochlorite or sodium hypochlorite and the solution shall be contained in the pipe or structure as specified.

PART 3 EXECUTION

3.01 APPLICATION

- A. Prior to chlorination all dirt and foreign matter shall be removed by a thorough cleaning and flushing of the pipeline or structure.
- B. The chlorine solution shall be admitted to pipelines through corporation stops placed in the horizontal axis of the pipe, to structures by means of tubing extending directly into the structure or other approved methods.

- C. The application of the chlorine solution shall be by means of a solution feed device. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the pipe or structure that the resulting free chlorine residual shall not be less than 100 parts per million (PPM), milligrams per liter (mg/l).
- D. The slug method may be used for chlorination of pipelines with the prior approval of the Engineer and shall be in accordance with AWWA C651, Section 5.3.
- E. The chlorine treated water shall be retained in the pipe or structure at least 24 hours, unless otherwise directed. During the retention period all valves and hydrants within the treated sections shall be operated.
- F. The chlorine residual shall be not less than 25 PPM (mg/l) at any point in the pipe or structure at the end of the retention period.
- G. When making repairs to or when specified, structures and portions of pipelines shall be chlorinated by a concentrated chlorine solution containing not less than 200 PPM (mg/l) of free chlorine. The solution shall be applied with a brush or sprayed on the entire inner surface of the empty pipes or structures. The surfaces disinfected shall remain in contact with the strong chlorine solution for at least 30 minutes.

3.02 FLUSHING

- A. After the required retention of chlorinated water in the pipe or structures they shall be thoroughly flushed until the replacement water shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served by the public from the existing water supply system.
- B. The disposal of chlorinated water from any pipe or structure shall be such that it will not cause damage to any vegetation, fish, or animal life and shall be in accordance with any requirements stated in the Special Provisions.

3.03 TESTING

- A. The Contractor shall make all arrangements for the testing of water quality. In areas where the testing of water quality is not performed by the public health authority, the Contractor shall have the required test made by an approved independent laboratory. The results of all tests shall be forwarded to the Engineer and the public health authority having jurisdiction.
- B. The Contractor shall provide the men and tools as may be required by the Engineer or the public health authority in the sampling for testing of water quality.

SECTION 02713
PLANT WATER SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

The plant water system shall consist of duplex vertical multi-stage centrifugal pump driven by a constant speed electric motors and shall include a hydro-pneumatic tank, and all valves, control panel, and accessories needed for a complete operating system.

B. Related Work Specified Elsewhere

1. Miscellaneous Valves and Traps: Section 15125
2. Miscellaneous Electric Motors: Section 16150
3. Tests on Pumping Equipment: Section 15988
4. Electrical General: Section 16010

C. Description of System

1. The plant water system shall consist of a duplex constant speed pumps be activated on low system pressure, and deactivated on high pressure by a pressure switch mounted on the hydro-pneumatic tank feed/discharge line. The pumps are connected to tank T-110 which receives plant effluent water.
2. The hydro-pneumatic tank shall be used to minimize pump cycling, by releasing water to the system after pump shutoff. The hydro-pneumatic tank shall supply the plant water system, until the pressure drops to 40 psig. When the pressure drops below 40 psig, the pump shall restart.
3. A flow control valve shall limit the feedrate to the hydro-pneumatic tank to approximately 30 gallons per minute.

1.02 SUBMITTALS

A. Shop Drawings

1. Prior to obtaining any equipment in connection with this section, the Contractor shall submit detailed shop drawings and descriptions of all components of the plant water system.
2. The information shall be furnished to the Engineer in accordance with the provisions set forth in the General Conditions.

3. The submittal shall include complete information and instructions relating to the storage, handling, installation, and inspection of system and related equipment.
4. The manufacturer shall submit a list of at least three installations of similar size which have been in successful operation for at least three years.

B. Materials

The Contractor shall submit, along with the Shop Drawings, a materials list which shall include full information regarding all components of the equipment. Materials of construction shall also be presented in the listing.

C. Other Submittals

Prior to installation of the proposed equipment, the Contractor shall furnish the required number of copies of the manufacturer's operation and maintenance manual for each unit.

PART 2 PRODUCT

2.01 PACKAGE WATER SYSTEM EQUIPMENT

A. Pump

1. The plant water pump shall be a vertical multi-stage centrifugal pump with the motor mounted directly to the top of the pump, Grundfos Model CR4-50U, or equal.
2. The pump shall be of the size and capacity as specified herein.
3. The pump suction, discharge and pump shaft coupling and motor stool shall be constructed of cast iron.
4. The impellers, diffuser chambers and pump shaft shall be constructed of stainless steel.
5. The impellers shall be secured directly to the pump shaft by means of a bronze or stainless steel tapered split cone and locking nut or locking screws.
6. Replaceable intermediate bearings shall be aluminum oxide.
7. Pumps shall be equipped with a high temperature mechanical seal constructed of tungsten carbide mounted in a stainless steel and bronze housing.
8. Pump motors shall be in accordance with the Materials and Performance Section entitled "Miscellaneous Electric Motors".

B. Hydro-Pneumatic Tank

1. The hydro-pneumatic tank shall consist of a fiberglass shell with a polyethylene bladder.
2. The tank shall have a capacity of 270 gallons and shall be rated for 100 psi.
3. The tank shall have a drawdown of 70 gallons at a 40-60 psi pressure range.
4. Tank shall be free standing on a polyethylene base and shall be as manufactured by Structural Fibers, Inc., or equal.

C. Miscellaneous Equipment

1. A field adjustable NEMA 7 pressure switch shall be provided for pump activation. Pressure switch shall be provided with hermetically sealed mercury switches and brass bourdon tubes, series DAF as manufactured by Mercoid Corp. or equal. Switch shall be provided with 5-100 psi adjustable operating range and dual switches in a NEMA 4 enclosure.
2. Discharge pressure gauge, 4" face, 0-100 psi.
3. Flow control valve to limit flow into the hydro-pneumatic tank to approximately 30 gallons per minute.

D. Design Criteria

1. Pumps

No. Required	2
Type	vertical, multistage centrifugal
Capacity	30 gpm @ 150 ft TDH
Speed	3500 rpm
Horsepower	3, explosion proof
Motor Characteristics	460/3/60

2. Hydropneumatic Tank

No. Required	1
Capacity	270 gal (min)
Draw Down @ 40/60 psi	70 gal (min)

E. Control Panel

1. The plant water system manufacturer shall supply a control panel and all appurtenance equipment as specified. The control panel shall comply with the applicable specifications of Division 16 entitled "Electrical".

2. Pump Control Panel

a. The following major equipment shall be provided with each enclosure:

- 1) NEMA 1 enclosure
- 2) Combination starters with overloads and manual reset
- 3) Hand-Off-Automatic selector switches
- 4) Red indicating lights
- 5) Control and timing relays as shown and required
- 6) Solid state limit switches as required
- 7) Other as required for a complete operating system
- 8) Power factor correction capacitors
- 9) Control transformer

b. The pumps and pump control panel shall be furnished as a coordinated assembly requiring only tie in of pressure switch and power supply (460V, 3ph, 60 hz) for a complete operating system.

2.02 PAINTING

A. The plant water system shall be provided with the manufacturers standard machinery finish.

2.03 SPARE PARTS

A. The Contractor shall provide the following spare parts:

- Two complete set of mechanical pump seals.
- Two set of pump bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pump shall be installed in accordance with the manufacturers recommendations and the provisions of this Section.

B. Pump installation and testing shall be done in accordance with Section 15800 entitled "Pumps - General" and Section 15988 entitled "Tests on Pumping Equipment".

3.02 TESTING

A. Proof of Satisfactory Operation

1. The Contractor shall furnish the services of a competent factory representative of each manufacturer who shall inspect the installation of the plant water system and related equipment for proper assembly and erection.

2. The factory representative shall start and operate the equipment and conduct operating tests to adequately show that the equipment has been properly installed and will function as herein specified. All tests shall be subject to the Engineer's approval.
3. The service by the factory representative shall be provided for a minimum of one manday and one trip to the site.

- END OF SECTION -

SECTION 02720
VAULTS AND INLETS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Valve vaults, and similar structures, complete with frames and covers, manhole steps and appurtenances as shown on the Contract Drawings.

B. Definitions

1. Class "C" Concrete

Class "C" concrete is designated as concrete with a 3,000 psi design compressive strength, 0.64 maximum water/cement ratio by weight, 5 1/2 minimum sack of cement per cu. yd.

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

- A. American Society for Testing and Materials (ASTM). The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

ASTM A48-83	Specification for gray iron castings.
ASTM C62-89a	Specification for building brick (solid masonry units made from clay or shale).
ASTM C91-89	Specification for masonry concrete.
ASTM C139-73	Specification for concrete masonry units for construction of catch basins and manholes.
ASTM C144-89	Specification for aggregate for masonry mortar.
ASTM C478-88a	Specification for precast reinforced concrete manholes sections.
ASTM C913-89	Specification for precast concrete water and wastewater structures

1.03 SUBMITTALS

- A. Prior to any field construction, the Contractor shall submit for review drawings and conformance data for materials to be used in the construction of vaults and inlets.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete

1. Cast-in-place concrete for vaults and inlets shall be as specified under the Section entitled "Concrete".
2. Precast concrete sections shall be in accordance with ASTM C478-88a for manhole sections and ASTM C913-89 for other structures with a minimum wall thickness of 5 inches. Top sections shall withstand H-20 wheel loads and shall be of the type shown.
 - a. Bell and spigot joints of precast sections shall have an appropriate "O" ring supplied by the manufacture or other types of joints as shown on the Contract Drawings.

B. Masonry Units

1. Brick shall meet the requirements of ASTM C-62-89a, Grade SW and shall be of a hard-burned manufacture.
2. Concrete blocks shall conform to the requirements of ASTM C139-73 and shall be solid and of the size shown on the Contract Drawings.

C. Mortar

Masonry cement for mortar shall meet the requirements of ASTM C 91-89, Type II and shall be mixed with a graded quality sand conforming to ASTM C 144.

Mix shall be 1 part masonry cement to 3 parts sand using the minimum amount of clean water required for workability.

D. Castings

1. Frames and covers, grates, inlets, and other castings shall be as shown on the Contract Drawings and be in accordance with ASTM A48-83, Class 30. All castings shall be manufactured to withstand H-20 wheel loads. Lettering shall be "Storm Sewers" or other appropriate designation cast as directed. Frames and covers shall have machined bearing surfaces.
2. Steps shall be manhole steps manufactured of cast iron in accordance with ASTM A48-83, Class 30 or others acceptable to the Engineer.
 - a. Steps shall have a minimum tread width of 12 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Precast Sections

1. Precast section shall be installed on a level subgrade of compacted granular material as shown or directed.
2. All joints shall be filled inside and out with mortar to provide a smooth and continuous surface.

B. Benchwalls and Inverts

Mortar surfaces of benchwalls and concrete floors shall be given a broom finish. Where inverts are required they shall be lined with a half section of pipe of the same type used for the sewer or shall be constructed of Class "C" concrete, shaped and troweled to produce a smooth circular cross-section.

C. Frames and Castings

Frames and castings shall be set in a full bed of mortar a maximum of 1/2" thick. Where required to adjust the frames and castings to grade, a maximum of four brick courses shall be installed.

D. Steps

1. Steps shall be installed in vertical alignment spaced 12-inches on center.
2. In concrete sections the steps shall be cast into the section or secured with cadmium plated bolts to threaded inserts which are precast into the concrete.
3. In masonry construction the steps shall be built into the masonry walls.

E. Plastering

1. Plaster shall be with mortar not less than 1/2-inch thick and troweled smooth.
2. Outside of masonry structures.
3. Inside and outside of brick courses under frames and castings.

F. Sumps

Sumps of the size specified shall be built into the floors of vaults and similar structures. Floors shall be sloped to the sump.

- END OF SECTION -

SECTION 02730
PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Precast concrete manholes shall include standard and drop manholes complete with frames and covers, manhole steps and appurtenances of the type scheduled with construction as shown on the Contract Drawings or Detail Drawings attached to and made a part of this Contract.

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

- A. American Society for Testing and Materials (ASTM). The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

ASTM A48-83	Specification for gray iron castings.
ASTM C62-89a	Specification for building brick (solid masonry units made from clay or shale).
ASTM C91-89	Specification for masonry concrete.
ASTM C144-89	Specification for aggregate for masonry mortar.
ASTM C478-88a	Specification for precast reinforced concrete manhole sections.

1.03 SUBMITTALS

A. Shop Drawings

1. Prior to any field construction, the Contractor shall submit for review drawings and conformance data for manhole sections, slabs, steps, frames and covers, location and size of base section opening and manhole step locations.
2. The submittals shall include such information which will ensure compliance with the codes, standards and specifications designated in the following "PRODUCTS" section.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manholes shall be constructed of precast reinforced concrete pipe sections as shown on the Contract Drawings.
- B. Masonry for manholes shall include brick courses required to bring the frames and/or covers to grade, and the work and materials required to install metal castings, pipes, sleeves or other related items for a complete installation as shown, specified or directed.
- C. All precast concrete manholes shall consist of the combination of barrel sections resulting in the fewest number of joints.

2.02 MATERIALS

A. Manhole Sections

- 1. Precast concrete pipe sections and slabs shall be constructed and reinforced in accordance with ASTM C-478-88a, with a minimum wall thickness of 5 inches and with joints having an "O" ring seal. Manhole sections shall be water-proofed on the exterior with a minimum of 2 coats of Koppers 300M or equal applied per the coating manufacturer's specifications.
- 2. Base sections shall have reinforced flat bottoms protruding 6 inches beyond the outside face of the riser section unless otherwise specified. The flat bottoms shall be a minimum of 8 inches in thickness:
- 3. Each opening in the base section for leachate collection piping up to and including 20 inch diameter shall contain a flexible rubber connection installed by the manufacturer of the base section.
 - a. Openings for drop inlet pipes are excepted from this requirement.
 - b. Flexible rubber connectors shall be:
 - 1. KOR-N-SEAL
 - 2. Lock Joint Flexible Manhole Sleeve
 - 3. An equal product of another manufacturer.
- 4. Top sections, tapered or flat, shall be adequate to withstand H-20 wheel loads. All top sections shall have eccentric openings. The edge of eccentric openings for flat top sections shall be a maximum of 2 inches from the inside wall of the barrel section.

B. Manhole Steps

1. Manhole steps shall be Copolymer Polypropylene plastic step Type PS2-PF as manufactured by M.A. Industries, Inc. or equal. The plastic steps shall be hand driven into preformed holes in cured concrete. The steps shall be a minimum of 12-inches wide and shall be in accordance with the manufacturer's instructions. Steps shall be installed in vertical alignment spaced 12-inches on center unless otherwise specified and shall be placed over the largest benchwall of the manhole.

C. Frames and Covers: All manhole frames and covers except where otherwise shown or specified shall be in conformance with items 1 and 2 below:

1. Manhole frames and covers shall be in accordance with ASTM A-48-83, Class 30A, and as specified in the Detail Drawing
2. Covers shall be provided with a minimum of two 1-1/2" x 3/4" slots unless otherwise noted. Frames and covers shall be adequate to bear H-20 wheel loads and shall be provided with machined bearing surfaces.

D. Mortar and Bricks

1. Masonry cement for mortar shall meet the requirements of ASTM C91-89, Type II and shall be mixed with a graded quality sand conforming to ASTM C144-89. Mix shall be one part masonry cement to 3 parts sand using the minimum amount of clean water required for workability.
2. Brick shall meet the requirements of ASTM C62-89a, Grade SW of a hard-burned manufacture. All bricks shall be whole, sound, straight, and of standard size.

E. Drop Manholes

Drop manholes shall be constructed in accordance with the Detail Drawings, and as follows:

1. The pipe stack, Y-branch and bends shall be of the same diameter as the influent sewer up to the maximum of 24-inches in diameter.
2. The opening in the manhole barrel for the drop inlet does not require a flexible pipe connector. A watertight seal shall be made between the manhole wall and inlet pipe using a universal compression type annular space sealer constructed of hard rubber links, joined together by bolts of corrosion resistant plated carbon steel or other type seal acceptable to the Engineer. The rubber link material shall remain flexible and be resistant to water and chemical action.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. Brick

1. Upon delivery of bricks to be used in the work, experienced personnel employed by the Contractor shall cull and sort bricks not meeting the requirements of this specification. All inferior quality bricks shall be immediately removed from the work site.

B. Precast Manhole Sections

1. All precast manhole barrel, base and top sections shall be stored and handled with extreme care to avoid structural damage to the units. Damage to units occurring as a result of storage or handling shall be cause for rejection.

3.02 INSTALLATION

- A. Precast manhole bases shall be installed on a level subgrade of compacted granular material as shown or directed.
- B. All joints on the inside and outside of the manhole shall be filled with mortar to provide a smooth and continuous surface.
- C. Manhole inverts shall be lined with a half section of pipe of the same size as the pipe used for the sewer or shall be constructed of Class 4,000 concrete, shaped and troweled to produce a smooth circular cross-section. Benchwalls shall have a slope of 1/2" on 12" and the mortar surface shall be given a broom finish.
- D. Mortar beds for brick or manhole frames shall be a maximum thickness of 1/2 inch.
- E. The Contractor shall furnish and install up to a maximum of four brick courses as required to adjust the frames to grade. The brick courses shall be plastered with 1/2" minimum of cement mortar inside and out.

3.03 TESTING

- A. All pre-cast concrete manholes shall be tested in accordance with Section 02602 - Leakage Tests.

3.04 FINAL INSPECTION

A. Visual Inspection

1. The manholes, vaults and inlets shall be visually inspected prior to final acceptance. Any defects or uncompleted work shall be corrected or finished before such acceptance will be granted.

- END OF SECTION -

SECTION 02830

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 DESCRIPTIONS

A. Work Specified

1. A complete fence with eight foot fabric, tension wire top and bottom, three strands of barbed wire and gates located as shown on the Contract Drawings and as specified. The work shall include the following, as a minimum:
 - a. Fence framework, fabric and accessories.
 - b. Excavation for post footings.
 - c. Concrete for post footings.
 - d. Gates and related hardware.

B. Related Work Specified Elsewhere

1. 02220 - Earthwork
2. 03001 - Concrete

1.02 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society for Testing and materials (ASTM).

ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
ASTM A120	Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
ASTM A121	Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
ASTM A392-89	Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
ASTM A428	Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles.

ASTM A491	Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
ASTM A569	Specification for Steel, Sheet and Strip, Carbon (0.15 Maximum Percent). Hot-Rolled, Commercial Quality.
ASTM A585	Specification for Aluminum-Coated Steel Barbed Wire.
ASTM A817	Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric.
ASTM A824	Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain-Link Fence.
ASTM B117	Method of Salt Spray (Fog) Testing.
ASTM C94	Ready-Mixed Concrete.
ASTM F567	Standard Practice for Installation of Chain-Link Fence.
ASTM F626	Specification for Fence Fittings.

1.04 QUALITY ASSURANCE

- A. Installation: Company specializing in commercial quality fence products with at least five years experience.
- B. Fence framework, fabric and related accessories to be a complete system as specified herein.

1.05 SUBMITTALS

- A. Shop Drawings: Include complete details of fence and gate construction, fence height, post spacing, dimensions and unit weights of framework and concrete footing details.
- B. Product Data: Five (5) copies of the manufacturer's certification that all materials furnished conform to the specified standards.
- C. Samples: Fence Framework: One piece of each size 12" long.
Fence Fabric: One piece 12" square.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Allied Tube & Conduit Corp.
- B. Anchor Fence, Inc.
- C. Cyclone Fence/United State Steel Corp.

- D. Substitutions: Products of other manufacturers equal to those specified can be used subject to prior review.

2.02 MATERIALS

- A. Frame work: Type I or Type II Steel Pipe.

Type I - Schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area conforming to Standard Specification ASTM A 120; or

Type II - pipe manufactured from steel conforming to ASTM A 569, cold-formed, high frequency welded and having a minimum yield strength of 50,000 PSI. External surface triple coated with 1.0 ounce \pm 0.1 ounce of zinc per square foot, 30 ± 15 micrograms of chromate per square inch and 0.5 ± 0.2 mils of clear, cross linked polyurethane. Internal surface coated, after welding, with a zinc-rich based organic coating having an 87% zinc powder loading capable of providing galvanic protection.

Pipe shall be straight, true to section and conform to the following weights:

<u>Pipe Size</u> <u>Outside Diameter</u>	<u>Type I</u> <u>Weight Lbs./Ft.</u>	<u>Type II</u> <u>Weight Lbs./Ft.</u>
1-5/8"	2.27	1.84
2"	2.72	2.28
2-1/2"	3.65	3.12
3"	5.79	4.64
3-1/2"	7.58	5.71
4"	9.11	6.56

- B. Fabric: Zinc-Coated or Aluminum-Coated steel.

Zinc-coated fabric shall be galvanized after weaving with a minimum 1.2 ounces of zinc per square foot of surface area and conform to ASTM A 392, Class I.

Aluminum-coated fabric shall be manufactured in accordance with ASTM A 491 and coated before weaving with a minimum of 0.1 ounces of aluminum per square foot of surface area. The steel wire and coating shall conform to ASTM A 817.

- C. Fittings: Pressed steel or cast iron, galvanized with a minimum of 1.2 ounces of zinc per square foot of surface area, or cast aluminum alloy, all conforming to ASTM F 626.

2.03 CONCRETE MIX

- A. ASTM C 94 Portland Cement concrete with maximum 3/4" aggregate having a minimum compressive strength of 2,500 PSI at 28 days.

2.04 COMPONENTS

A. Fence Posts:

<u>Fabric Height</u>	<u>Line Post O.D.</u>		<u>Terminal Post O.D.</u>	
	<u>Type I</u>	<u>Type II</u>	<u>Type I</u>	<u>Type II</u>
Under 6'	2"	2"	3"	2½"
6' to 9'	2½"	2½"	3"	3"
9' to 12'	3"	3"	4"	3½"

B. Gate Posts:

<u>Single Gate Width</u>	<u>Double Gate Width</u>	<u>Post O.D.</u>	
		<u>Type I</u>	<u>Type II</u>
Up to 6'	Up to 12"	3"	3"
7' to 12'	13' to 25'	4"	3½"
13' to 18'	25' to 36'	6-5/8"	---

C. Rails and Braces:

1-5/8" O.D. Type I or Type II.

- D. Fabric: Galvanized or aluminum-coated steel wire, 9 gage, woven in a 2" diamond mesh with top selvage twisted and barbed and bottom selvage knuckled. Fence heights up to 12' to be one-piece widths.

- E. Gates: Frame assembly of 2" O.D. Type I or Type II pipe with welded joints. Weld areas repaired with zinc-rich coating applied per manufacturer's directions. Fabric to match fence. Gate accessories, hinges, latches, center stops, keepers and necessary hardware of quality required for industrial and commercial application. Latches shall permit padlocking of gate. Locks shall be a 5 pin tumbler type, Master lock #6 or equivalent. All site locks shall be keyed alike and six (6) copies must be supplied to the NJDEP. Barbed wire installed at top of gates.

F. Fittings:

Post Caps - Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts.

Rail and Brace Ends - Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.

Top Rail Sleeves - Tubular steel, 0.051 thickness x 7" long, expansion type.

Tension Bars - Steel strip, 5/8" wide x 3/16" thick.

Tension Bands - Pressed steel, 14 gage thickness x 3/4" wide.

Brace Bands - Pressed steel, 12 gage thickness x 3/4" wide.

Truss Rods - Steel rod, 3/8" diameter merchant quality with turnbuckle.

Barbed Wire Arms - Pressed steel, cast iron or cast aluminum alloy fitted with clips or slots for attaching three strands of barbed wire. Arms shall be set outward on a 45 degree angle and be capable of supporting a 250 pound load at outer barbed wire connecting point without causing permanent deflection.

- G. Tension Wire: Marcellled 7 gage steel wire with minimum coating of 0.80 ounces of zinc or 0.10 ounces of aluminum per square foot of wire surface and conforming to ASTM A 821.
- H. Barbed Wire: Commercial quality steel, 12-1/2 gage, three strand twisted line wire with 4 point barbs at 5 inch spacing. Coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A 121 or a minimum of 0.30 ounces of aluminum per square foot of wire surface conforming of ASTM A 585.
- I. Tie Wires: Aluminum 9 gage, alloy 1100-H4 or equal.
- J. Hog Rings: Steel wire, 11 gage with a minimum zinc coating of 0.80 ounces per square foot of wire surface.

PART 3 EXECUTION

3.01 INSPECTION

- A. Contractor shall examine site and report in writing to Engineer any conditions detrimental to the proper and timely completion of the work. Clearing, grading and fence line layout and staking of terminals to be completed by Contractor before start of fence installation. The grading of the fence line shall not impact the surface water flow.
- B. Contractor shall receive reviewed Shop Drawings from Engineer before starting installation.

3.02 INSTALLATION

- A. General: Fence installation to conform to requirements of ASTM F 567.
- B. Secure Fence: The Contractor shall secure fence fabric to discourage theft of fence fabric at the site. This shall be

accomplished by welding the fence fabric to each third post at a minimum of three locations per post, in the middle of the post and at the top and bottom. All the welds shall be treated to prevent corrosion.

- C. Height: Provide fence heights as indicated on contract drawings.
- D. Post Spacing: Space line posts at intervals not exceeding ten feet.
- E. Post Setting: Set terminal, gate and line posts plumb in concrete footings as indicated on contract drawings. Top of footing to be 2'' above grade and sloped to direct water away from posts.
- F. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.
- G. Top Rail: Install through line post loop caps connecting sections with sleeves to form a continuous rail between terminal posts. Fasten to terminal posts.
- H. Bottom Tension Wire: Stretch between terminal posts no more than 6" above grade and fasten to outside of line posts with tie wires. It shall also be fastened to the fabric every 18 inches with either wire ties or hog rings. Any straight runs over 500 feet shall be braced with horizontal bracing.
- I. Fabric: Pull fabric taut to provide a smooth uniform appearance, free from sag, with bottom selvage no more than 2" above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15" intervals. Tie to line posts and top rails with tie wires spaced at maximum 12" on posts and 24" on rails. Attach to bottom tension wire with hog rings at maximum 24" intervals.
- J. Barbed Wire: Anchor to terminal extension arms, pull taut to remove all sag and firmly install in slots of line post extension arms. Barbed wire shall support 200 lb. weight.
- K. Gates: Install gates plumb, level and secure for full opening without interference. Anchor center stops and keepers in concrete. Adjust and lubricate hardware for smooth operation.
- L. Fasteners: Install nuts for fittings, bands and hardware bolts on inside of fence. Peen ends of bolts or score threads to prevent removal.

SECTION 02980
TOPSOIL AND SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. The furnishing of topsoil, fertilizer, seed, and mulch; the preparation of the subgrade and the placing of the topsoil, fertilizer, seed and mulch.
2. The maintenance required until acceptance.

B. Related Work Specified Elsewhere

1. Vegetative Layer: Section 02293
2. Flexible Membrane Cover: Section 02294

1.02 TESTING

- A. All soil testing services as specified herein necessary for the Contractor to obtain approved topsoil and seeding materials shall be provided by the Contractor. All testing including laboratory and field services required during construction of the topsoil and seeding layer shall be provided by the Contractor.
- B. The Contractor shall use Rutgers Soils Testing Laboratory for the Soil Testing Services.

1.03 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. American Society for Testing and Materials (ASTM). The publications listed below form a part of the specification to the extent referred to in the text by basis designation only.

ASTM D422-63	Method for Particle Analysis of Soil
ASTM D2974-87	Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Materials
ASTM 2973-71	Test Method for Total Nitrogen in Peat Materials, of Peat and Other Organic Soils
ASTM 2976-71	Test Method for pH of Peat Materials

1.04 SUBMITTALS

- A. Source of borrow materials for topsoil layer.

- B. Location of sample collected within borrow area for laboratory testing.
- C. Laboratory testing methods to be used.
- D. Results of laboratory testing methods.
- E. Laboratory certification of topsoil material.
- F. Required surface disturbance permits.
- G. Manufacturer's certification of seed mixture.
- H. Manufacturer's certification of fertilizer.
- I. Recommendations for fertilizer and lime application rates based on soil testing.
- J. Proposed method for anchoring the mulch over the seeded areas.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Topsoil for planting shall be natural friable loam, typical of productive cultivated topsoils of the locality, containing at least 5% of decayed organic matter, pH 5.5 to 7.5, free of subsoil, stones, earth clods, weeds, roots, sticks, debris, toxic substances and other objectionable and extraneous matter 2 inch or more in greatest dimension. Topsoil shall be furnished from approved, well drained off-site source if the on-site material occurs to be of unsatisfactory quality or in insufficient amount.
- B. Contractor may amend natural topsoil with approved materials and by approved methods to meet the above specifications. Materials used to amend the organic content of topsoil may be, or may include, approved recycled and/or composted material. Amendments shall not include or contain any material that is deleterious to soil structure, plant growth or seed germination.
- C. Topsoil shall meet the following requirements:
 - 1. The pH of the material shall be between 5.0 and 7.5
 - 2. The organic content shall be not less than 2.75% nor more than 20%.
 - 3. Soluble salts shall not exceed 0.5 millimohs per centimeter.
 - 4. The gradation of the topsoil shall be within the following ranges:

If more than one-half the sand is
smaller than 0.5 mm:

sand (2.000 mm to 0.050 mm)

Percent

40-80

silt (0.050 mm to 0.005 mm)		0-30
clay (0.005 mm and smaller)		0-30
If more than one-half the sand is larger than 0.5 mm:	<u>Percent</u>	<u>Percent</u>
sand (2.00 mm to 0.050 mm)	40-80 or	40-75
silt (0.050 mm to 0.005 mm)	0-30 or	0-30
clay (0.005 mm and smaller)	5-30 or	0-30

Materials outside these ranges are not suitable for use as topsoil

- D. The Contractor shall submit testing methods (prior to conducting tests), test results, and a certification from the approved soils testing laboratory that the topsoil meets the requirements of this Section. The results of all soils testing shall be submitted to the Engineer for approval.
- E. The results of all testing shall be submitted to the Engineer for approval. Any materials not meeting the requirements of this Section shall be considered as unacceptable unless otherwise agreed to by the Engineer.
- F. During installation of the topsoil layer, material from the topsoil source shall be tested in accordance with the following standards and frequencies:

<u>Parameter</u>	<u>Standard</u>	<u>Minimum Frequency</u>	<u>Criteria</u>
Particle Size Analysis	ASTM D422-63	Once per 3,200 cy	In accordance with part 2.01 B of this section
Moisture, Ash, and Organic Matter of Peat and Other Organic Soils	ASTM D2974-87	Once per 3,200 cy	

- G. If at any time during this Contract the Engineer requests further soils testing to insure that the characteristics of the topsoil material from the borrow area(s) have not changed, the Contractor shall perform these tests at no additional cost to the State. The State will pay for testing if the challenged material meets the requirement in this specification.

2.02 GRASS SEED

- A. Seed shall be state-certified seed of the current season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed-seed content, and inert material. Grass seed mixture shall be fresh, clean of current season's

crop. Seed shall be labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy or otherwise damaged will not be acceptable.

B. Seed Mixtures:

<u>Kind of Seed</u>	<u>Cultivar</u>	<u>% of Total Weight of Mixture</u>
Fine Fescues		80%
Chewing	Banner or Jamestown	20%
Spreading	Fortress of Ensylva	20%
Hard	Reliant or Spartan or SR 300	20%
Sheeps	Bighorn or Azay	20%
Kentucky Bluegrass	Kenblue, or Park, or Delta or Troy or Arboretum or a blend of two or more of the above.	10%
Perennial Ryegrass	Repell or Citation II or Blazer II	5%
Red Top		4%
White Clover		1%

C. Seed Rate

Seeding for the above mix shall be 100 lb./acre.

D. Seeding Dates

Seeding dates shall be those specified for the appropriate Plant Hardiness Zone in the NJ Standards for Soil Erosion and Sediment Control, Permanent Vegetative Cover for Soil Stabilization, Table 3.2-1, B., 1. Low Maintenance Areas.

E. Seed Application

All seeding shall be performed using a corrugated roller landscape seeder such as the Brillion SSLP-642 to ensure good seed to soil contact. Hydraulic (Hydro Seeding) Seeding will be allowed on 3:1 slopes greater or greater or in areas with excessive obstacles.

2.03 COMPOST

- A. Compost shall contain organic matter, or material of generally humus nature capable of sustaining the growth of vegetation, with no admixture of material toxic to plant growth. It shall be free of stones, lumps or similar objects larger than 2 inches in greater diameter, roots and brush. Composts that have been derived from organic wastes such as food and agriculture residues, and animal manures, that meet the above requirements, and are approved by the State, are acceptable compost sources.

Compost shall have an approximate N-P-K analysis of at least 1-1-0 as delivered with a pH between 5.5 and 8.5 and a solids content of at least 50%.

2.04 FERTILIZER

- A. Fertilizer shall be of commercial stock, of neutral character, with elements derived from organic sources.
- B. Fertilization at seeding shall be at a rate of 300 lb./acre using a 10-20-10 fertilizer. Fertilizer shall be applied prior to the application of limestone (if required) and be incorporated into the soil with the limestone. If limestone is not applied then the fertilizer shall be incorporated into the top 2" of the topsoil.
- C. Six (6) months after seeding a second fertilizer application is required with 300 lb./acre of 10-10-10 fertilizer. This shall only be a surface application.
- D. Limestone application shall comply with NJDOT Standard Specification Section 808 if the pH is less than 5.8 to bring the soil pH up to 6.5.

2.05 MULCH

- A. Mulching of the seedbed shall comply with the NJDOT Standard Specifications Section 811, Mulching.

PART 3 - EXECUTION

3.01 INSTALLATION LOCATIONS FOR LANDSCAPE MATERIALS

- A. The areal extent of the completed cover shall be covered by a minimum of 6 inches of topsoil meeting the requirements of this Section. It shall then be seeded, mulched and fertilized in accordance with this Section.
- B. All surfaces excluding the cover as described above which have been constructed during the course of the contract or that have been disturbed or damaged during completion of the work shall receive a minimum of 6 inches of topsoil. All other surfaces shall be seeded in accordance with this section. All surfaces shall then be mulched and fertilized in accordance with this Section.

3.02 APPLICATION PROCEDURES

- A. Finished grade shall conform to the tolerance, lines and grades as shown. Any irregularities shall be corrected before the placement of grass seed, fertilizer and mulch.
- B. The Contractor shall proceed with the complete landscape work as rapidly as portions of the Contract Work Area become available, working within seasonal limitations (i.e. winter conditions

excessive rainfall, etc.) for each kind of work required. Unless approved by the Engineer, seeding shall proceed only between 3/1-5/15 and 8/15-10/1.

- C. The fertilizer shall be applied uniformly with a mechanical spreader at a rate based upon results of soil tests. Following the application of the fertilizer and prior to application of the seed, the surface shall be scarified to a depth of 2 inches with a disk or other suitable method.
- D. The grass seed mixture shall be applied uniformly upon the prepared surface at a rate of not less than five pounds per 1000 square feet. Seeding shall be suspended when wind velocities exceed 5 miles per hour or as directed by the Engineer.
- E. Seeded areas shall then be protected from erosion by application of a uniform continuous 2" thick blanket of mulch. Excessive amounts or bunching of mulch will not be permitted. Mulch shall be left in place and allowed to disintegrate and shall be anchored as required by a method approved by the Engineer in a submittal. Any anchorage or mulch that has not disintegrated at time of first mowing shall be removed.
- F. Following application of the mulch, the seed bed shall be moistened by Contractor at no additional expense to the State. A muddy soil condition will not be acceptable.
- G. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory growth by Contractor at no additional expense to the State. Watering shall be done in such a manner as to prevent washing out of seed and damaging of the cover.
- H. The stand of grass resulting from the seeding shall not be considered satisfactory until accepted by the Engineer. If areas are determined to be unacceptable, the remaining mulch will be removed and all areas shall be scarified reseeded, refertilized and remulched as per the above application procedures at the Contractor's expense.
- I. Hydroseeding may be accepted as a method of applying fertilizer, lime, seed and mulch to areas inaccessible or inappropriate to a mechanical seeder. The Contractor must submit all data regarding materials and application rates to the Engineer for approval if hydroseeding is proposed by the Contractor.

3.03 MAINTENANCE

- A. The Contractor shall begin maintenance period immediately after planting of landscape materials.
- B. The Contractor shall maintain the landfill cover including mowing all grass areas for the warranty period specified in the Operation of Systems Section. This period is not to be less than 1 year.

SECTION 03001

CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Formwork, shoring, bracing, and anchorage.
- B. Concrete reinforcement and accessories.
- C. Cast-in-place concrete.
- D. Control, expansion and contraction joint devices associated with concrete work.
- E. Placement of sleeves, inserts and anchor bolts.

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

- A. Section 13121 - Pre-Engineered Buildings: Metal Fabrications attached to formwork.

1.03 REFERENCES

- A. ACI 301-84 Specifications of Structural Concrete for Buildings.
- B. ACI 318-83 - Building Code Requirements for Reinforced Concrete.
- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready-Mixed Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C260 - Air Entraining Admixtures for Concrete.
- H. CRSI - Manual of Standard Practice.
- I. ASTM C1116 - Fiber-Reinforced Concrete and Shotcrete.
- J. FS-TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.
- K. ANSI/ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- L. ANSI/ASTM D1565 Flexible Cellular Materials - Vinyl Chloride Polymers or Copolymers (Open Cell Foam).

- M. ANSI/ASTM D1752-84 - Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- N. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
- O. ACI 305R - Hot Weather Concreting.
- P. ACI 306R - Cold Weather Concreting.
- Q. ASTM C494 - Chemical Admixtures for Concrete.
- R. ASTM C920-87 - Specification for Elastomeric Joint Sealants

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301-84.
- B. Maintain copy of ACI 301-84 on site.

1.05 TESTS

- A. Testing and analysis of concrete will be performed under applicable Section of the General Conditions.
- B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- C. Slump tests for fiber reinforced concrete will be taken per recommendations of ACI committee 544 and will be externally vibrated, not internally rodded.
- D. Field testing shall be done by ACI certified field testing technician - Grade I.

1.06 SUBMITTALS

- A. Submit shop drawings of reinforcing steel under the applicable Section of General Conditions.
- B. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing steel, and wire fabric, bending and cutting schedules, splicing, and supporting and spacing devices.
- C. Indicate arrangement of joints.
- D. Submit fiber reinforcing data and mixing instructions.
- E. Submit manufacturer's literature for admixtures.
- F. Submit proposed mix design for review prior to commencement of work.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Conform to ACI 301-84.
- B. Form Ties: Snap-off metal, of adjustable length.

2.02 REINFORCING

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet steel deformed bars; uncoated finish.
- B. Fiber reinforcing: ASTM C-1116, Type III, Performance Level 1, Collated fibrillated polypropylene (CFP) fibers added to concrete mix at a minimum rate of 1.5 lbs per cu. yd. Fiber lengths shall be based on top size of coarse aggregate as follows:

<u>Aggregate Size</u>	<u>Fiber Length</u>
3/4"	1/2" - 3/4"

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal, Portland, grey color.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

- A. Air Entrainment Admixture: ASTM C260.
- B. Water reducing Admixture: ASTM C494.

2.05 ACCESSORIES

- A. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum 28-day compressive strength of 6000 psi.
- B. Form Release Agent: Colorless material which will not stain concrete or absorb moisture.
- C. Waterstop - 9" polyvinyl chloride, ribbed, heat-sealed joints with integral wire loops; Wirestop manufactured by Paul Murphy Plastics Co.
- D. Sealants: Polyurethane, 2 component, FSTT-S-0027E, Type I, Class A, ASTM C-920, Type M, Grade P, Class 25, use NT, M.

- E. Backer Rod: ANSI/ASTM D1056, D1565, round, foam rod, oversized 30 to 50% larger than joint width. Must be compatible with sealant.
- F. Joint Filler: ANSI/ASTM D1752, closed cell polyethylene, neoprene, or polyvinyl chloride foam: resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.
- G. Bond Breaker: 6 mil polyethylene or 15 pound roofing felt.

2.06 CURING MATERIALS

- A. Water: Clean and drinkable.
- B. Absorptive Mat: Burlap-polyethylene, 8 oz/sq yd, bonded to prevent separation during use.

2.07 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.
- B. All Concrete:
 - 1. Compressive Strength
(7 days): 3000 psi
 - 2. Compressive Strength
(28 days): 4000 psi
 - 3. Slump: 3 inch
 - 4. Maximum Water/Cement
Ratio: .45
 - 5. Air Content: $5\frac{1}{2}\pm 1$ percent
- C. Add air entraining agent to mix for concrete exposed to freeze-thaw cycling.
- D. Use water reducing admixtures in all concrete.

PART 3 - EXECUTION

3.01 FORMWORK ERECTION

- A. Verify lines, levels, and measurement before proceeding with formwork.
- B. Hand trim sides and bottom of earth forms; remove loose dirt.
- C. Align form joints.
- D. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.02 REINFORCEMENT

- A. Place, support, and secure reinforcement against displacement.
- B. Mix CFP fiber reinforcing with concrete in truck at jobsite in proportions per manufacturer's printed instructions.
- C. Support Reinforcement with chairs and similar support accessories as required and in conformance with CRSI "Manual of Standard Practice" Chapter 3 - Bar Supports.

3.03 PLACING CONCRETE

- A. Notify Engineer minimum 24 hours prior to commencement of concreting operations.
- B. Concrete placement during cold weather shall comply with ACI 306R.
- C. Concrete placement during hot weather shall comply with ACI 305R.

3.04 FLOOR SLABS

- A. Work and finish CFP fiber reinforced concrete slabs per recommendations of manufacturer.
- B. Saw cut control joints at an optimum time after finishing. Cut slabs with 3/16 inch (5 mm) thick blade, cutting 1/4 of depth of slab thickness.
- C. Separate slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- D. Trowel finish surfaces.
- E. Moist-cure slabs in accordance with ACI 301-84, 12.2.1.1 to 12.2.1.6 inclusive.

3.05 FORMED SURFACES

- A. Rough form finish at unexposed surfaces of walls and grade beams.
- B. Smooth rubbed finish at Exposed Concrete.
- C. Patch snap tie holes in all surfaces.

3.06 TOLERANCES

- A. Provide Class B tolerance to floor slabs according to ACI 301-84.

- END OF SECTION -

SECTION 03307

CONCRETE FOR PIPELINES, VAULTS AND INLETS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified

1. All cast-in-place concrete used in the construction of pipelines, vaults, and inlets, cradles, encasements, thrust blocks, anchors, and manholes.
2. Reinforcing steel, formwork, and items of concrete accessories required for the completion of the work.

1.02 QUALITY ASSURANCE

A. Applicable Codes, Standards and Specifications

1. American Society for Testing and Materials (ASTM)
2. American Concrete Institute (ACI)

B. Tests

1. Tests for all materials shall be current within the past twelve (12) months prior to use in the work.
2. Make available to the Engineer upon request.

1.03 SUBMITTALS

- A. Name and location of concrete supplier.
- B. Concrete mix design indicating amount of all ingredients for each class of concrete to be used in the work.
- C. Manufacturer's literature for curing compounds, joint materials, admixtures, etc.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement

1. Conform to ASTM C150, Type II.
2. Type I or III may be employed with the Engineer's approval.

- B. Fine and Coarse Aggregates
 - 1. Comply in all respects to ASTM C33.
 - 2. Maximum size of coarse aggregate
 - 3. General concrete - 1-1/2 inches (NYSDOT #1's and #2's)
- C. Water
 - 1. Use public potable water supply.
 - 2. Clear and free from injurious substances.
- D. Admixtures
 - 1. Water reducing - conform to ASTM C 494, Type A.
 - 2. Air-entraining - conform to ASTM C260.
 - 3. Reinforcing steel bars shall be deformed new billet steel conforming to ASTM A615, Grade 60. Wire fabric shall be cold drawn steel conforming to ASTM A185.
- E. Grout
 - 1. All grout shall be non-shrink, non-metallic, non-gas forming, preblended and ready for use requiring only the addition of water.

PART 3 EXECUTION

3.01 CONCRETE MIX DESIGN

- A. Mix design shall be established by the concrete supplier based on a proven strength record for concrete made with similar ingredients.
- B. Conform to ACI 211, except as specified herein, using approved materials.
- C. The various classes of concrete are designated as follows:

<u>Class</u>	<u>Design Compressive Strength at 28 Days, psi</u>	<u>Maximum Water/Cement Ratio by Weight</u>	<u>Minimum Sack of Cement Per Cu. Yd</u>
B	40000	0.50	6
B (air-entrained)	4000	0.44	6-1/2
C	3000	0.64	5-1/2

3.02 MAXIMUM SLUMP

- A. General - 4 inches
- B. Use minimum water possible subject to workability.

3.03 BATCHING AND MIXING

- A. Batching
 - 1. The Contractor shall have at his disposal a modern and dependable batch plant within a reasonable distance from the work.
 - 2. Conform to ACI 304.
 - 3. Use only approved materials.
- B. Mixing and Delivery
 - 1. Conform to ASTM C94.

3.04 PLACING CONCRETE

- A. Conform to ACI 304.
 - 1. Forms shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced and tied so as to maintain position and shape during and after placing of concrete.
 - 2. The Contractor shall build into the concrete reinforcing steel, sleeves, waterstops, etc., as shown on the Contract Drawings, or in restoration work, reinforcing steel and other embedded items equal to that found in the concrete being replaced.
 - 3. All concrete shall be thoroughly consolidated by the use of vibrators or by spading or puddling sticks and tampers.
 - 4. No concrete shall be deposited under water without written permission of the Engineer and then only in accordance with proper tremie techniques.
 - 5. Cold weather concreting: conform to ACI 306.
 - 6. Hot weather concreting: conform to ACI 305.

3.05 CURING

- A. Concrete shall be maintained in a moist condition for seven (7) days using methods that will insure complete and continuous saturation.

SECTION 04100

MORTAR

PART 1 GENERAL

1.01 SECTION INCLUDES

1. Mortar and grout for masonry.

1.02 RELATED WORK

- A. Section 04340 - Reinforced Unit Masonry System: Installation of mortar and grout.
- B.. Section 08111 - Standard Steel Doors and Frames: Grouting steel door frames.

1.03 REFERENCES

- A. ASTM C91 - Masonry Cement.
- B. ASTM C94 - Ready-Mixed Concrete.
- C. ASTM C144 - Aggregate for Masonry Mortar.
- D. ASTM C150 - Portland Cement.
- E. ASTM C270 - Mortar for Unit Masonry.
- F. ASTM C404 - Aggregates for Masonry Grout.
- G. ASTM C476 - Grout for Masonry.
- H. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- I. ASTM C1019 - Method of Sampling and Testing Grout.
- J. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.04 SUBMITTALS

- A. Submit product data under General Conditions.
- B. Include design mix, indicate Proportion or Property method used, required environmental conditions, and admixture limitations.
- C. Samples: Submit under General Conditions.
- D. Samples: Submit two ribbons of mortar color, illustrating color and color range.

- E. Submit test reports on mortar indicating conformance to ASTM C270 or C780.
- F. Submit test reports on grout indicating conformance to ASTM C476 or C1019.
- G. Submit manufacturer's certificate that products meet or exceed requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under General Conditions.
- B. Store and protect products under General Conditions.
- C. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.07 MIX TESTS

- A. Testing of Mortar Mix: In accordance with ASTM C780.
- B. Testing of Grout Mix: In accordance with ASTM C1019.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type I, color as selected.
- B. Masonry Cement: ASTM C91, Type S.
- C. Mortar Aggregate: ASTM C144, standard masonry type.
- D. Grout Aggregate: ASTM C404.

2.02 MORTAR MIXES

- A. Mortar for Non-load Bearing Walls and Partitions: ASTM C270, Type S using the Property Method.
- B. Mortar for Reinforced Masonry: ASTM C270, Type S using the Property Method.

2.06 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

- B. Do not use anti-freeze compounds to lower the freezing point of mortar.
- C. If water is lost by evaporation, retemper only within two hours of mixing.
- D. Use mortar within two hours after mixing at temperatures of 80 degrees F, or two-and-one-half hours at temperatures under 50 degrees F.

2.04 GROUT MIXES

- A. Bond Beams: Engineered Masonry: 2500 psi strength at 28 days; 7-8 inches slump; premixed type in accordance with ASTM C94 or mixed in accordance with ASTM C476 Course grout.

2.05 GROUT MIXING

- A. Mix concrete in accordance with ASTM C94.
- B. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C476 Course grout.
- C. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Request inspection of spaces to be grouted.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Section.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove grout spaces of excess mortar.

- END OF SECTION -

SECTION 04300
UNIT MASONRY SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

1.02 RELATED SECTIONS

- A. Section 04100 - Mortar: Mortar and grout.

1.03 REFERENCES

- A. ANSI/ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- D. ASTM C90 - Hollow Load Bearing Concrete Masonry Units.
- E. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
- F. UL - Underwriters' Laboratories.

1.04 SUBMITTALS

- A. Submit product data under General Conditions.
- B. Submit product data for masonry units and fabricated wire reinforcement.
- C. Submit manufacturer's certificate under General Conditions products meet or exceed specified requirements.
- D. Submit manufacturer's installation instructions.

1.05 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under General Conditions.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate work under General Conditions.
- B. Coordinate the masonry work with installation of anchors and lintels

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units: ASTM C90, Grade S, Type II - Non-moisture Controlled; normal weight.
- B. Masonry Units: Nominal modular size of 6" x 8" x 16 inches. Provide special units for 90 degree corners, bond beams.

2.02 REINFORCEMENT AND ANCHORAGE

- A. Single Wythe Joint Reinforcement: Truss type; hot dip galvanized after fabrication cold-drawn steel conforming to ANSI/ASTM A82, 3/16 inch side rods manufactured by Dur-O-Wall or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.

- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form flush mortar joints.

3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C. Remove excess mortar as Work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 REINFORCEMENT AND ANCHORAGES - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first horizontal joints above and below openings.
- C. Place joint reinforcement continuous in first joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches. Extend minimum 16 inches each side of openings.

3.06 LINTELS

- A. Install loose steel lintels over window openings, door openings.

3.07 BUILT-IN WORK

- A. As work progresses, build in metal door frames, anchor bolts and other items furnished by other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build in organic materials subject to deterioration.

3.08 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- B. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation From Plumb: 1/4 inch (6 mm) per story non-cumulative.
- D. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet.
- E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.
- F. Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.09 CLEANING

- A. Clean work under General Provisions.
- B. Remove excess mortar and mortar smears.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.10 PROTECTION OF FINISHED WORK

- A. Protect finished installation under General Conditions.
- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

- END OF SECTION -

SECTION 04340
REINFORCED UNIT MASONRY SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete masonry.
- B. Reinforcement, anchorage, and accessories.

1.02 RELATED SECTIONS

- A. Section 04100 - Mortar: Mortar and grout.
- B. Section 07900 - Joint Sealers: Rod and sealant at joints.

1.03 REFERENCES

- A. ANSI/ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
- D. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
- E. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- F. ASTM C90 - Hollow Load Bearing Concrete Masonry Units.
- G. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.04 SUBMITTALS

- A. Submit product data under General Conditions.
- B. Submit product data for masonry units and fabricated wire reinforcement.
- C. Submit manufacturer's certificate under General Conditions that products meet or exceed specified requirements.

1.05 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum 3 years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to UL Assembly No. U901 requirements for fire rated masonry construction.

1.07 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this Section, under General Conditions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under General Conditions.
- B. Store and protect products under General Conditions.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate work under General Conditions.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I - Moisture Controlled; normal weight.

2.02 REINFORCEMENT AND ANCHORAGE

- A. Single Wythe Joint Reinforcement: Truss type; hot dip galvanized after fabrication cold-drawn steel conforming to ANSI/ASTM A82 3/16 inch side rods with 3/16 inch cross ties.
- B. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, unprotected finish.

2.03 ACCESSORIES

- A. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding; 1/2 inch wide by maximum lengths.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.04 LINTELS

- A. Precast Concrete Lintels: Reinforced type, 7 5/8 x 7 5/8 inch size, 3000 psi strength at 28 days.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C. Remove excess mortar as Work progresses.
- D. Interlock intersections and external corners.

- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler and Fire Brand Caulk.

3.05 REINFORCEMENT AND ANCHORAGES - REINFORCED UNIT MASONRY

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches. Extend minimum 16 inches each side of openings.
- E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.06 LINTELS

- A. Install precast concrete lintels over door openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
- C. Openings Up To 42 Inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
- D. Openings From 42 Inches Up To 78 Inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
- E. Use single piece reinforcing bars only.
- F. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- G. Place and consolidate grout fill without displacing reinforcing.
- H. Allow masonry lintels to attain specified strength before removing temporary supports.
- I. Maintain minimum 4 inch bearing on each side of opening.

3.06 GROUTED COMPONENTS

- A. Reinforce bond beam with 2, No. 5 bars, 1 inch from bottom web.
- B. Reinforce pilaster with No. 5 bars, placed 4'-0" horizontally.
- C. Lap splices minimum 24 bar diameters.
- D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- E. Place and consolidate grout fill without displacing reinforcing.

3.07 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.
- B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before placing grout.
- C. Reinforce masonry unit cores with reinforcement bars and grout as indicated.
- D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Section 03001.
- E. Grout spaces less than 2 inches (50 mm) in width with fine grout using low lift grouting techniques. Grout spaces 2 inches (50 mm) or greater in width with course grout using high or low lift grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- G. Low Lift Grouting: Place first lift of grout to a height of 16 inches (400 mm) and rod for grout consolidation. Place subsequent lifts in 8 inch (200 mm) increments and rod for grout consolidation.
- H. High Lift Grouting:
 - 1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
 - 2. Clean out masonry cells with high pressure water spray. Permit complete water drainage.
 - 3. After cleaning and cell inspection, seal openings with masonry units.

4. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
5. Limit grout lift to 48 inches and rod for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.08 BUILT-IN WORK

- A. As work progresses, build in metal door frames and other items furnished by other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build in organic materials subject to deterioration.

3.09 TOLERANCES

- A. Maximum Variation From Alignment of Pilasters: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- D. Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.10 CUTTING AND FITTING

- A. Cut and fit for pipes conduit sleeves and ductwork. Coordinate with other Sections of work to provide correct size, shape, and location.
- B. Obtain Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 CLEANING

- A. Remove excess mortar and mortar smears.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03301 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04340 - Unit Masonry System: Placement of metal fabrications in masonry.

1.03 RELATED SECTIONS

- A. Section 05520 - Handrails and Railings.
- B. Section 09900 - Painting: Paint finish.
- C. Section 13121 - Pre-Engineered Buildings.

1.04 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- D. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- E. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- F. AWS A2.0 - Standard Welding Symbols.
- G. AWS D1.1 - Structural Welding Code.
- H. SSPC - Steel Structures Painting Council.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

- B. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.06 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- B. Welders' Certificates: Submit under General Conditions certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.07 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Pipe: ASTM A53, Grade B Schedule 40.
- E. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Shop and Touch-Up Primer: Tnemec Series 10-99 or equivalent.
- H. Touch-Up Primer for Galvanized Surfaces: Zinc rich type.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES

- A. Prepare surfaces to be primed in accordance with SSPC SP 2.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with two coats, 2.0-3.5 mils DFT per coat.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required, unless allowed by primer manufacturer.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.

- F. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

3.04 SCHEDULE

- A. Door frames for overhead door openings: Channel sections; prime paint finish.
- B. Steel Platform: As detailed, prime paint finish.
- C. Steel Access Ladders: As detailed; prime paint finish.

- END OF SECTION -

SECTION 05510

METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel stair frame of structural sections, with open risers.
- B. Open grate stair treads and landings.
- C. Integral balusters and handrailing.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03301 - Cast-In-Place Concrete: Placement of metal anchors in concrete.

1.03 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Bearing plates angles for metal stairs, including anchorage.
- B. Section 05520 - Handrails and Railings: Handrails and balusters other than specified in this Section.
- C. Section 09900 - Painting: Paint finish.

1.04 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A202.1 - Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- J. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

- K. AWS A2.0 - Standard Welding Symbols.
- L. AWS D1.1 - Structural Welding Code.
- M. SSPC - Steel Structures Painting Council.

1.05 DESIGN REQUIREMENTS

- A. Fabricate stair assembly to support live load of 100 lb/sq ft with deflection of stringer or landing framing not to exceed 1/240 of span.
- B. Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.

1.06 SUBMITTALS

- A. Submit under provisions of General Conditions.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.07 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- B. Welders' Certificates: Submit under provisions of General Conditions certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Pipe: ASTM A53, Grade B Schedule 40.
- E. Sheet Steel: ASTM A446, Grade B Structural Quality with 1.25 oz/sq ft galvanized coating.
- F. Gratings: ANSI A202.1, Type GWB.

- G. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
- H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- I. Welding Materials: AWS D1.1; type required for materials being welded.
- J. Shop and Touch-Up Primer: Tnemec 1099 or equivalent.
- K. Touch-Up Primer for Galvanized Surfaces: Zinc rich type.

2.02 FABRICATION - GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Continuously seal jointed pieces by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.

2.05 FABRICATION - OPEN GRATING STAIRS AND LANDINGS

- A. Fabricate treads in accordance with ANSI A202.1 of welded steel bars, bolted to supports; galvanized finish.
- B. Form hollow stringers with rolled steel channels prime paint finish.
- C. Form landings in accordance with ANSI A202.1 galvanized finish. Reinforce underside with angles to attain design load requirements.
- D. Form balusters with 1 1/2 inch diameter steel sections, welded to stringers; prime paint finish.

2.04 FINISHES

- A. Prepare surfaces to be primed in accordance with SSPC SP 2.

- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Do not prime surfaces in direct contact with concrete or where field welding is required.
- D. Prime paint items with two coats.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete and/or embedded in masonry with setting templates, to appropriate sections.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, plates and angles required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.
- E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible.
- F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- G. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

- END OF SECTION -

SECTION 05520
HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel pipe handrails, balusters, and fittings.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03301 - Cast-In-Place Concrete: Placement of anchors in concrete.

1.03 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Attachment plates and angles for metal stairs, including anchorage.
- B. Section 05510 - Metal Stairs: Handrails other than specified in this Section.
- C. Section 09900 - Painting: Paint finish.

1.04 REFERENCES

- A. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- B. SSPC - Steel Structures Painting Council.

1.05 DESIGN REQUIREMENTS

- A. Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.

1.06 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.07 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 STEEL RAILING SYSTEM

- A. Pipe: ASTM A53, Grade B Schedule 40.

- B. Mounting: brackets and flanges, with steel inserts for casting in concrete. Prepare backing plate for mounting in gypsum wall construction.
- C. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- D. Splice Connectors: Steel welding collars.
- E. Shop and Touch-Up Primer: Tnemec Series 10-99, 2.0-3.5 mils DFT or equivalent.

2.02 FABRICATION

- A. Fit and shop assemble components in largest practical sizes, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Continuously seal joined pieces by continuous welds.
- F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Accurately form components to suit stairs and landings, to each other and to building structure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete and placed in partitions with setting templates, to appropriate Sections.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, plates and angles required for connecting railings to structure. Anchor railing to structure.
- C. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- D. Conceal bolts and screws whenever possible.

- END OF SECTION -

SECTION 05531
GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed metal stair treads, floor gratings, and fiberglass floor gratings.
- B. Flat surface floor plating.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03301 - Concrete: Placement of grating frames in concrete.

1.03 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications.
- B. Section 05510 - Metal Stairs: Framing for grating and stair treads.
- C. Section 09900 - Painting: Field paint finish.

1.04 REFERENCES

- A. ANSI/AWS A2.4 - Standard Symbols for Welding, Brazing and Nondestructive Examination.
- B. ANSI/AWS D1.1 - Structural Welding Code, Steel.
- C. ANSI/NAAMM MBG 531 - Metal Bar Grating Manual.
- D. ANSI/NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual.
- E. ASTM A36 - Structural Steel.
- F. ASTM A123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
- G. ASTM A510 - General Requirements for Wire Rods and Course Round Wire, Carbon Steel.
- H. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- I. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
- J. ASTM B210 - Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

- K. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- L. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.

1.05 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for applicable loads.

1.06 SUBMITTALS

- A. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.
- C. Indicate welded connections using standard ANSI/AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Product Data: Provide span and deflection tables.
- E. Samples: Submit two samples, 3 x 3 inch in size illustrating surface finish, color, and texture.

1.07 QUALIFICATIONS

- A. Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- B. Welders' Certificates: Submit under provisions of General Conditions certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

1.09 COORDINATION

- A. Coordinate the work with placement of frames, tolerances for placed frames and openings.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Formed Steel For Welding ASTM A569 or ASTM A36, of shapes indicated.
- B. Cross Bars: ASTM B510.
- C. Welding Materials: ANSI/AWS D1.1; type required for materials being welded.

- D. Fiberglass grating shall be fiberglass reinforced thermal cored, molded from Derakane 411 vinyl ester, one piece molded construction, consisting of bi-directional bearing bars approximately 3.4 to 3.75 psf.
- E. Shop and Touch-Up Primer: Tnemec Series 10-99 or equivalent.
- F. Touch-Up Primer for Galvanized Surfaces: Zinc rich type.

2.02 ACCESSORIES

- A. Fasteners and Saddle Clips: Galvanized steel as required.
- B. Perimeter Closure: Of same material as grating.
- C. Support pedestals for fiberglass grating.
- D. Adhesives for pedestal supports.

2.03 FABRICATION

- A. Grating Type: ANSI/NAAMM MBG 531, Welded GWB Type and plates to accommodate design loads.
- B. Bolt joints of intersecting metal sections.
- C. Top Surface: Non-slip.

2.04 FINISHES

- A. Prepare surfaces to be primed in accordance with SSPC SP-2 and of foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with two coats, 2.0-3.5 mils DFT per coat.
- D. Galvanizing: ASTM A525.
- E. Non-slip Surfacing: Aluminum oxide.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes and dimensional tolerances are acceptable.
- B. Verify that supports anchors are correctly positioned.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.

- B. Place frames in correct position, plumb and level.
- C. Mechanically cut galvanized finish surfaces. Do not flame cut.
- D. Anchor by bolting through saddle clips.
- E. Set perimeter closure flush with top of grating and surrounding construction.
- F. Secure to prevent movement.

- END OF SECTION -

SECTION 06114

WOOD BLOCKING, CURBING AND FRAMING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Roof curbs.
- B. Blocking in wall and roof openings.
- C. Wood furring and grounds.
- D. Concealed wood blocking for support of wall mounted items.
- E. Wood treatment.
- F. Wood framing.

1.02 RELATED WORK

- A. Roof openings to receive wood curbs and cants.

1.03 REFERENCES

- A. ALSC - American Lumber Standards Committee: Softwood Lumber Standard.
- B. APA - American Plywood Association: Grades and Standards.
- C. FS TT-W-571 - Wood Preservation: Treating Practices.
- D. NFPA - National Forest Products Association.
- E. SFPA - Southern Forest Products Association.
- F. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- G. WWPA - Western Wood Products Association.

1.04 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.

1.05 SUBMITTALS

- A. Submit product data under General Conditions of the Contract.
- B. Provide technical data on wood preservative materials and application instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Lumber Grading Rules: NFPA, WHPA.
- B. Plywood: APA Grade C-D, with waterproof glue, sanded; for mounting boards.
- C. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.
- D. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolts or ballistic fasteners for anchorages to steel.

2.02 WOOD TREATMENT

- A. Wood Preservative: FS TT-W-571 AHPA Treatment C2 using water borne preservative with 0.30 percent retainage.

PART 3 EXECUTION

3.01 SITE APPLIED WOOD TREATMENT

- A. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings.
- B. Apply preservative treatment in accordance with manufacturer's instructions.
- C. Treat site-sawn ends.
- D. Allow preservative to cure prior to erecting members.

3.02 INSTALLATION

- A. Erect wood framing members level and plumb.
- B. Space framing and furring 16 inches oc.
- C. Curb all roof openings except where prefabricated curbs are provided. Form corners by lapping side members alternatively.
- D. Coordinate work with installation of decking and support of decking at openings.

- END OF SECTION -

SECTION 06125

WOOD DECKING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Plywood decking.
- B. Pressure impregnated preservative treatment.

1.02 Related Work

- A. Section 06114 - Wood Blocking, Curbing and Framing.

1.03 REFERENCES

- A. AITC - American Institute of Timber Construction.
- B. APA - American Plywood Association.
- C. AWPA - American Wood Preservers' Association.
- D. AWPI - American Wood Preservers' Institute.
- E. FS TT-W-571 - Wood Preservation: Treating Practices.
- F. NFPA - National Forest Products Association.

1.04 SYSTEM DESCRIPTION

- A. Design Floor Live and Dead Load: 60 lbs/sq ft with deflection limited to 1/360.

1.05 QUALITY ASSURANCE

- A. Plywood Grading Agency: Certified by APA.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, Store and protect products under General Conditions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Lumber Grading Rules: NFPA.
- B. Plywood: APA Structural I, Grade C-D; sanded.

SECTION 07160
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cold applied asphalt bitumen damproofing.
- B. Protective cover.

1.02 RELATED SECTIONS

- A. Section 02224 - Backfilling.
- B. Section 03301 - Concrete: Concrete surfaces.
- C. Section 07212 - Board Insulation: Perimeter and horizontal insulation.

1.03 REFERENCES

- A. ASTM D41 - Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
- B. ASTM D491 - Asphalt Mastic Used in Waterproofing.
- C. ASTM D2822 - Asphalt Roof Cement.
- D. NRCA (National Roofing Contractors Association) - Waterproofing Manual.

1.04 SUBMITTALS

- A. Submit under General Conditions.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.

1.06 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum 3 years experience.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until membrane has cured.

PART 2 PRODUCTS

2.01 COLD ASPHALTIC MATERIALS

- A. Asphalt Mastic: ASTM D491.
- B. Asphalt Primer: ASTM D41, compatible with substrate.
- C. Asphalt Cement: ASTM D2822 Type I.

2.02 ACCESSORIES

- A. Protection Board: Rigid insulation specified in Section 07212.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- B. Verify items which penetrate surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer or applicator.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.03 APPLICATION

- A. Prime surfaces in accordance with NRCA - Waterproofing Manual.
- B. Apply cold bitumen with roller.
- C. Apply from 2 inches below finish grade elevation to top of footings.
- D. Seal items projecting through dampproofing surface with mastic. Seal watertight.

3.04 PROTECTION

- A. Immediately backfill against dampproofing to protect from damage.
- B. Neatly fit boards tight around pipe and other projections.

- END OF SECTION -

SECTION 07212
BOARD INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor and air barrier at perimeter foundation wall underside of floor slabs.

1.02 RELATED SECTIONS

- A. Section 07213 - Batt and Blanket Insulation.

1.03 REFERENCES

- A. ANSI/ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- B. ASTM C240 - Testing Cellular Glass Insulating Block.
- C. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.
- D. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
- E. FS HH-I-530 - Insulation Board, Thermal, Unfaced, Polyurethane or Polyisocyanurate.
- F. FS HH-I-551 - Insulation Block and Boards, Thermal (Cellular Glass).
- G. FS HH-I-1972/GEN - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.

1.04 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 13121 and Section 07213.

1.05 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance criteria, limitations.
- B. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation, installation techniques.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS - INSULATION MATERIALS

- A. Substitutions: Under General Conditions.

2.02 INSULATION MATERIALS

- a. Polystyrene Insulation Type B: ASTM C578 Type VI extruded cellular type, conforming to the following:

Thermal Resistance	R of 5.0
Thickness	Thickness indicated
Board Size	24 x 48 inch
Compressive Strength	Minimum 30 psi
Water Absorption	In accordance with ANSI/ASTM D2842 0.3 percent by volume maximum
Edges	Square edges

2.03 ADHESIVES

- A. Adhesive: Type recommended by insulation manufacturer for application.

2.04 ACCESSORIES

- A. Sheet Barrier: Black polyethylene film for above grade application, 10 mil thick.
- B. Tape: Polyethylene self- adhering type, mesh reinforced, 2 inch wide.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.
- B. Verify substrate surface is flat, free of honeycomb irregularities.

SECTION 07213

BATT AND BLANKET INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt insulation and vapor barrier in exterior wall and roof construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED SECTIONS

- A. Section 07212 - Board Insulation.
- B. Section 13121 - Pre-Engineered Building: Batt within metal wall and roof cladding system.

1.03 REFERENCES

- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. FS HH-I-521 - Insulation Blankets, Thermal, (Mineral Fiber for Ambient Temperatures).
- C. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).

1.04 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 13210.

1.05 SUBMITTALS

- A. Submit under General Conditions.
- B. Product Data: Provide data on product characteristics, performance criteria, limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS - INSULATION MATERIALS

- A. Certainteed.

B. Substitutions: Under General Conditions.

2.02 MATERIALS

- A. Batt Insulation: FS HH-I-521 Type membranes II - with non-reflective membrane one side FS HH-I-558 ASTM C665; preformed glass mineral fiber batt roll; friction fit, conforming to the following:

Thermal Resistance R of 19

Batt Roll Size 6-1/2 x 18 inch

Facing Unfaced Faced on one side with
 asphalt treated mesh
 reinforced Kraft paper

- B. Sheet Barrier: White or black polyethylene film reinforced with glass fiber square mesh, 3 mil thick.
- C. Nails Staples: Steel wire; electroplated galvanized; type and size to suit application.
- D. Tape: Polyethylene self- adhering type, mesh reinforced, 2 inch wide.
- E. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.
- F. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.02 INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior walls and roof spaces without gaps or voids.
- C. Trim insulation neatly to fit spaces.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- E. Tape in place. Retain in place with spindle fasteners at 6 inches.

- F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- G. Metal Framing: Place vapor and air barrier on warm side of insulation; lap and seal sheet barrier joints over member face.
- H. Extend vapor and air barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

- END OF SECTION -

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

1.02 RELATED SECTIONS

- A. Section 03301 - Concrete: Sealants required in conjunction with cast-in-place concrete.
- B. Section 04340 - Reinforced Masonry: Sealants required in conjunction with concrete masonry.
- C. Section 07160 - Bituminous Dampproofing: Sealants required in conjunction with dampproofing.
- D. Section 13121 - Pre-Engineered Building Systems: Sealants required in conjunction with siding, and roofing.
- E. Section 08112 - Steel Door Frames: Sealants required in conjunction with door frames.
- F. Section 13210 - Pre-Engineered Building Systems: Sealants required in conjunction with aluminum windows.
- G. Section 09650 - Resilient Flooring: Sealants required in conjunction with floor and base finish.

1.03 REFERENCES

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C920 - Elastomeric Joint Sealants.
- E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- F. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- G. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.04 SUBMITTALS

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- B. Samples: Submit two samples, 1 x 1 inch in size illustrating sealant colors for selection.
- C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing the work of this section with minimum 3 years experience.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 COORDINATION

- A. Coordinate the work with all sections referencing this section.

PART 2 PRODUCTS

2.01 SEALANTS

- A. Bituminous Based (Type B): Single component, asphalt compound, elongation capability of 0 to 2 percent of joint width.
- B. Acrylic Emulsion Latex (Type C): ASTM C834, single component; color as selected.
- C. Polysulfide Sealant (Type F): ASTM C920, Grade NS, Class 25 Use NT; two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected.
 - 1. Elongation Capability 25 percent
 - 2. Service Temperature Range -40 to 180 degrees F

3. Shore A Hardness Range 20 to 35
- D. Polyurethane Sealant (Type I): ASTM C920, Grade P, Class A, Use NT, M; two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging or self-leveling type, color as selected.
 1. Elongation Capability 25 percent min.
 2. Service Temperature Range -40 to 180 degrees F
 3. Shore A Hardness Range 20 to 35
- E. Silicone Sealant (Type J): ASTM C920, Grade NS, Class 25, Use NT; single component, fungus resistant, chemical curing, non-sagging, non-staining, non-bleeding; color as selected.
 1. Elongation Capability 25 percent
 2. Service Temperature Range -65 to 180 degrees F
 3. Shore A Hardness Range 15 to 25

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1565; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.

- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

3.03 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

- END OF SECTION -

SECTION 08111
STANDARD STEEL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-rated, fire rated and thermally insulated steel doors.
- B. Louvers.

1.02 RELATED SECTIONS

- A. Section 04100 - Mortar: Masonry mortar fill of metal frames.
- B. Section 08112 - Standard Steel Frames.
- C. Section 08712 - Door Hardware.
- D. Section 09900 - Painting: Field painting of doors.

1.03 REFERENCES

- A. ANSI/SDI-100 - Standard Steel Doors and Frames.
- B. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. ASTM C236 - Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot-Box.
- D. ASTM E152 - Methods of Fire Tests of Door Assemblies.
- E. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- F. NFPA 80 - Fire Doors and Windows.
- G. NFPA 252 - Fire Tests for Door Assemblies.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finish.
- B. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.
- C. Samples: Submit two samples of door face metal, 3 x 3 inch in size illustrating pre-finished door colors and surface texture.

- D. Manufacturer's Installation Instructions: Indicate special installation instructions.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Fire Rated Door Construction: Conform to ASTM E152, NFPA 252.
- B. Fire Rated Door Construction: Rate of rise of 450 F degrees across door thickness.
- C. Installed Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of General Conditions.
- B. Protect doors with resilient packaging.
- C. Break seal on-site to permit ventilation.

1.09 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by the manufacturer.

1.10 COORDINATION

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

PART 2 PRODUCTS

2.01 DOOR MANUFACTURERS

- A. Pioneer Product Series HT.
- B. Substitutions: Under General Conditions.

2.02 DOORS

- A. Exterior Doors (Non-thermally Broken): SDI-100 Grade III Model 1.
- B. Interior Doors (Non-rated): SDI-100 Grade III Model 1.
- C. Interior Doors (Fire Rated): SDI-100 Grade III Model 1.

2.03 DOOR CONSTRUCTION

- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: polystyrene foam.
- C. Thermal Insulated Door: Total insulation R value of value of 11, measured in accordance with ASTM C236.

2.04 ACCESSORIES

- A. Louvers: Manufactured by Pioneer or equivalent.
 - 1. Material and Finish: Roll formed steel; color as selected.
 - 2. Louver Blade: Inverted V blade, sight proof.
 - 3. Louver Free Area: 50 percent.
 - 4. Frame: Standard style with tamper proof fasteners.
- B. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- C. Primer: Zinc chromate type.

2.05 FABRICATION

- A. Astragals for Double Doors: Steel Z shaped, specifically for double doors.
- B. Fabricate doors with hardware reinforcement welded in place.
- C. Attach fire rated label to each door unit.
- D. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal joints watertight.
- E. Configure exterior doors with special profile to receive recessed weatherstripping.

2.06 FINISH

- A. Steel Sheet: Galvanized to ASTM A525.

- B. Primer: Tnemec Series 10-99, 2.0-3.5 mils DFT or equivalent.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install doors in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate installation of glass and glazing.
- C. Install door louvers, plumb and level.
- D. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 08710.

3.03 ADJUSTING

- A. Adjust door for smooth and balanced door movement.

- END OF SECTION -

SECTION 08112
STANDARD STEEL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-rated, fire rated and thermally insulated steel frames.

1.02 RELATED SECTIONS

- A. Section 04100 - Mortar: Masonry mortar fill of metal frames.
- B. Section 08111 - Standard Steel Doors.
- C. Section 08712 - Door Hardware.
- D. Section 09900 - Painting: Field painting of frames.

1.03 REFERENCES

- A. ANSI/SDI-100 - Standard Steel Doors and Frames.
- B. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. ASTM E152 - Methods of Fire Tests of Door Assemblies.
- D. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- E. NFPA 80 - Fire Doors and Windows.
- F. NFPA 252 - Fire Tests for Door Assemblies.

1.04 SUBMITTALS

- A. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement.
- B. Manufacturer's Installation Instructions: Indicate special installation instructions.
- C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Fire Rated Frame Construction: Conform to ASTM E152, NFPA 252.
- B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under General Conditions.
- B. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.09 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by the manufacturer.

1.10 COORDINATION

- A. Coordinate the work with frame opening construction, door and hardware installation.

PART 2 PRODUCTS

2.01 FRAME MANUFACTURERS

- A. Pioneer Product Series F-16.
- B. Substitutions: Under General Conditions.

2.02 FRAMES

- A. Frames: To suit ANSI/SDI-100 Grade and Model of door specified in Section 08111.

2.03 ACCESSORIES

- A. Silencers: Resilient rubber fitted into drilled hole.
- B. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- C. Bituminous Coating: Fibered asphalt emulsion.
- D. Primer: Tnemec Series 10-99 or equivalent.

2.04 FABRICATION

- A. Fabricate frames as welded unit for drywall slip-on type.
- B. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
- C. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- D. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

2.05 FINISH

- A. Steel Sheet: Galvanized to ASTM A525.
- B. Primer: 2.0-3.5 mils DFT.
- C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate with masonry, wallboard and exterior wall construction for anchor placement.
- C. Coordinate installation of glass and glazing.
- D. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08111.
- E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

- END OF SECTION -

SECTION 08331
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead coiling doors operating hardware, manual operation.

1.02 RELATED SECTIONS

- A. Section 13121 - Pre-Engineered Building: Support framing.
- B. Section 08712 - Door Hardware: Cylinder core and keys.
- C. Section 09900 - Painting: Field paint finish.

1.03 REFERENCES

- A. ANSI/ASTM A526 - Steel Sheet, Zinc-coated (Galvanized) by the Hot-dip Process, Commercial Quality.
- B. ANSI/ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. ANSI/UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
- D. ASTM A480 - Flat Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip.
- E. ASTM A525 - General Requirements for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- H. NEMA MG1 - Motors and Generators.
- I. ULI - Underwriters' Laboratories Inc.

1.04 SYSTEM DESCRIPTION

- A. Manual hand chain lift unit with overhead counter balance device.
- B. Within a framed opening.

1.05 DESIGN REQUIREMENTS

- A. Design door assembly to withstand wind/suction load of 20 psf without undue deflection or damage to door or assembly components.
- B. Insulation Value: R of 7.

1.06 SUBMITTALS

- A. Submit under General Conditions.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- C. Product Data: Provide general construction, component connections and details.
- D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

1.07 MAINTENANCE DATA

- A. Maintenance Data: Indicate lubrication requirements and frequency, periodic adjustments required.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by the manufacturer.

1.09 COORDINATION

- A. Coordinate the work with installation of Metal Framing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Kinnear Model Insul-Tite.
- B. Substitutions: Under provisions of General Conditions.

2.02 MATERIALS

- A. Curtain: as indicated on Drawings; conforming to the following:
 - 1. Slats: Interlocking, minimum 22 gage of ANSI/ASTM A526 steel, galvanized to minimum 1.25 oz/sq ft coating in accordance with ASTM A525; sandwich slat construction with insulated core of EPS type insulation.
 - 2. Nominal Slat Size: 2 inches wide x required length.

3. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 4. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact with floor in closed position.
- B. Guides: 2 inch wide rolled steel track continuous, vertical mounted; galvanized steel mounting brackets.
 - C. Roller Shaft Counterbalance: Steel pipe and steel spring system, capable of producing torque sufficient to assure smooth operation of curtain from any position; with adjustable spring tension.
 - D. Hood Enclosure: 24 gage galvanized steel; internally reinforced to maintain rigidity and shape.
 - E. Hardware:
 1. Handle: Inside side mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position; interior handle.
 2. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure.

2.04 FINISHES

- A. Curtain Slats: Galvanized steel.
- B. Steel Guides and Hood Enclosure: Prime paint, Prepare for paint finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
- F. Install perimeter trim and closures.

3.02 ADJUSTING

- A. Adjust door hardware and operating assemblies.

3.03 CLEANING

- A. Clean door and components.
- B. Remove labels and visible markings.

- END OF SECTION -

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow steel overhead doors.
- B. Thresholds.
- C. Weatherstripping, seals and door gaskets.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 08112 - Standard Steel Frames: Furnish templates for frame preparation.
- B. Section 08111 - Standard Steel Doors: Furnish templates for door preparation.

1.03 RELATED SECTIONS

- A. Section 08111 - Standard Steel Doors.
- B. Section 08112 - Standard Steel Frames.
- C. Section 08331 - Overhead Coiling Doors: Lockable coiling doors.
- D. Section 10441 - Plastic Signs.

1.04 REFERENCES

- A. NFPA 80 - Fire Doors and Windows.
- B. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
- C. NFPA 252 - Fire Tests of Door Assemblies.
- D. Fire Tests of Door Assemblies.
- E. UL 305 - Panic Hardware.
- F. ANSI A117.1 - Providing accessibility and usability for physically handicapped people.

1.05 SUBMITTALS

- A. Submit under General Conditions.
- B. Submit manufacturer's parts list, templates.

- C. Samples: Submit 1 sample of hinge, latchset, illustrating style, color, and finish.
- D. Samples: Will be returned to supplier.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.06 PROJECT RECORD DOCUMENTS

- A. Record actual locations of installed cylinder and their master key code.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit under General Conditions.
- B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.08 QUALITY ASSURANCE

- A. Perform work in accordance with the following requirements:
 - 1. NFPA 101.
 - 2. ANSI A117.1
 - 3. NFPA 80.
 - 4. NFPA 252.

1.09 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with 3 years experience.
- C. Hardware Supplier Personnel: Employ a qualified person to assist in the work of this section.

1.10 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements applicable to fire rated doors and frames.

1.11 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this section under General Conditions.

1.12 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of General Conditions.
- B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- C. Deliver keys to state by security shipment direct from hardware supplier.

1.13 COORDINATION

- A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

1.14 WARRANTY

- A. Provide five year warranty.
- B. Warranty: Include coverage for door closers.

1.15 MAINTENANCE MATERIALS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.16 EXTRA MATERIALS

- A. Provide ten extra key lock cylinders for each master keyed group.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Hinges: Stanley
- B. Latch Sets; Sargent
- C. Push/Pulls: Sargent
- D. Cylinder Locks; Sargent
- E. Mortise Locks: Sargent
- F. Exit Devices: Sargent
- G. Closers: LCM
- H. Gasketing: Zero

- I. Thresholds: Reese, Pemko, National Guard.
- J. Substitutions: Under General Conditions.

2.03 KEYING

- A. Door Locks: Keyed in like-groups.

2.04 FINISHES

- A. Finishes: Identified in schedule at end of section.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions.
- B. Use templates provided by hardware item manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation

3.05 PROTECTION OF FINISHED WORK

- A. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULES

Hardware Sets

Note:

1. All finishes shall be US 32 D - Brushed Chrome.
2. Knurled knobs on all doors entering into a hazardous area.
3. All locks shall be mortise Government Type 86.

Set No. 1

Single Exterior Doors

- 1 1/2 Pr. Butts
- 1 Closer
- 1 Exit Device.
- 1 Stop
- 2 Cylinders
- 1 Thresholds

Set No. 2

Double Exterior Doors

- 3 Pr. Butts
- 1 Closer
- 1 Exit Device
- 2 Stops
- 2 Cylinders
- 1 Pr. flush Bolts
- 1 Threshold

Set No. 3

Single Interior Doors

- 1 1/2 Pr. Butts
- 1 Closer
- 1 Lock
- 1 Stop
- 1 Cylinder

Set No. 4

Toilet Room Doors

- 1 1/2 Pr. Butts
- 1 Closer
- 1 Pull Handle
- 1 Push Handle
- 1 Stop
- 1 Kick Plate 30 x 12 x 0.50

Note: Provide Interior Lock on Women's Room

Set No. 5

Interior Double Doors

- 3 Pr. Butts
- 2 Closers
- 1 Pr. Exit Devices
- 2 Stops
- 1 Coordinator
- 1 Carry Bar

- END OF SECTION -

SECTION 09260
GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Gypsum board.
- D. Taped and sanded joint treatment.

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS.

- A. Section 10800 - Toilet and Bath Accessories: Frames for recessed washroom accessories.

1.03 RELATED SECTIONS

- A. Section 08112 - Standard Steel Frames.
- B. Section 09900 - Painting.
- C. Section 08111 - Standard Steel Doors.

1.04 REFERENCES

- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C442 - Gypsum Backing Board and Core Board.
- C. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- D. ASTM C630 - Water Resistant Gypsum Backing Board.
- E. ASTM C645 - Non-Load Axial Bearing Steel Studs, Runners Track, and Rigid Furring Channels for Screw Application of Gypsum Board.
- F. ANSI/ASTM C646 - Steel Drill Screws for the Application of Gypsum Sheet Metal to Light Gage Steel Studs.
- G. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.
- H. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- I. ASTM E119 - Fire Tests of Building Construction and Materials.

- J. GA-201 - Gypsum Board for Walls and Ceilings.
- K. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

1.05 QUALITY ASSURANCE

- A. Applicator: Company specializing in performing the work of this section with 3 years experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies as follows:
 - 1. Fire Rated Partitions: Listed assembly by UL No. 412.

1.07 SUBMITTALS

- A. Provide product data on metal framing, gypsum board, joint tape, and joint compound.
- B. Submit manufacturer's installation instructions under General Conditions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - GYPSUM BOARD SYSTEM

- A. U.S. Gypsum.
- B. Substitutions: Under provisions of General Conditions.

2.02 FRAMING MATERIALS

- A. Studs and Tracks: ASTM C645; GA 20 and GA 216; galvanized sheet steel, 12 gage 'C' shape.
- B. Furring, Framing and Accessories: ASTM C645. GA 201 and GA 216.
- C. Fasteners: ANSI/ASTM C646, GA 201 and GA 216.

2.03 GYPSUM BOARD MATERIALS

- A. Standard Gypsum Board: ASTM C36; 1/2, 5/8 inch thick, maximum permissible length; ends square cut, tapered edges.
- B. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 1/2, 5/8 inch thick, maximum permissible length; ends square cut, tapered edges.
- C. Moisture Resistant Gypsum Board: ASTM C630; 1/2 inch thick, maximum permissible length; ends square cut, tapered edges.
- D. Gypsum Backing Board: ASTM C442; fire rated type; 5/8 inch thick; edges, ends square cut, maximum permissible length.

2.04 ACCESSORIES

- A. Corner Beads: Metal and paper combination.
- B. Edge Trim: GA 201 and GA 216; Type LC bead.
- C. Joint Materials: ASTM C475; GA 201 and GA 216; reinforcing tape, joint compound, adhesive, and water.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturers.
- B. Beginning of installation means acceptance of substrate.

3.02 METAL STUD INSTALLATION

- A. Install studding in accordance with ANSI/ASTM C754, GA 201 and GA 216.
- B. Metal Stud Spacing: 16 inches on center.
- C. Partition Heights: To 6 inches above suspended ceilings. Install additional bracing for partitions extending above ceiling or where no ceiling exist.
- D. Door Opening Framing: Installing double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- E. Blocking: Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets toilet accessories, hardware.
- F. Coordinate installation of bucks, anchors, blocking, electrical and mechanical work placed in or behind partition framing.

3.03 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C754, GA 201 and GA 216.
- B. Coordinate location of hangers with other work.
- C. Install ceiling framing independent of walls, columns, and above-ceiling work.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
- E. Laterally brace entire suspension system.

3.04 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA 201 and GA 216.
- B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
- D. Use screws when fastening gypsum board to metal furring or framing.
- E. Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions. place second layer parallel to first layer. Offset joints of second layer from joints of first layer.
- F. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- G. Place control joints consistent with lines of building spaces as directed.
- H. Place corner beads at external corners. use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

3.05 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finish.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/16 inch.

- END OF SECTION -

SECTION 09511
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.
- C. Non-fire rated Fire rated assembly.

1.02 RELATED SECTIONS

- A. Section 15330 - Sprinkler Systems: Sprinkler heads in ceiling system.
- B. Section 15936 - Air Outlets and Inlets: Air diffusion devices in ceiling system.
- C. Section 16510 - Interior Luminaries: Light fixtures in ceiling system.

1.03 REFERENCES

- A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM E1264 - Classification of Acoustical Ceiling Products.
- D. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.
- E. UL - Fire Resistance Directory and Building Material Directory.

1.04 SYSTEM DESCRIPTION

- A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.05 SUBMITTALS

- A. Product Data: Provide data on metal grid system components, acoustical units and
- B. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

- C. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, edge trim.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.06 QUALIFICATIONS

- A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for combustibility requirements for materials.

1.08 SEQUENCING

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustical units after interior wet work is dry.

1.09 EXTRA MATERIALS

- A. Provide 10 percent of total acoustical unit area of extra tile to the Owner.

PART 2 PRODUCTS

2.01 SUSPENSION SYSTEM MATERIALS

- A. Non-fire Rated Grid: ASTM C635, heavy duty; exposed T components die cut and interlocking.
- B. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- C. Exposed Grid Surface Width: 15/16 inch
- D. Grid Finish: color as selected.
- E. Accessories: clips splices edge moldings hold down clips required for suspended grid system.

2.02 ACOUSTICAL UNIT MATERIALS

A. Acoustical Panels: ASTM E1264, conforming to the following:

1. Size: 24 x 48
2. Thickness: 5/8 inches
3. Composition: Mineral.
4. Density: 27 lb/cu ft
5. Light Reflectance: 75% percent.
6. NRC Range: 55 to 65
7. STC Range: 35 to 39
8. Fire Hazard Classification: Class A
9. Edge: Square.
10. Surface Color: As selected.
11. Surface Finish: As selected.

PART 3 EXECUTION

3.01 EXAMINATION

- #### A.
- Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- #### A.
- Install suspension system in accordance with ASTM C636 manufacturer's instructions and as supplemented in this section.
- #### B.
- Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- #### C.
- Locate system on room axis according to reflected plan.
- #### D.
- Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- #### E.
- Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- #### F.
- Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- H. Do not eccentrically load system, or produce rotation of runners.
- I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.
- D. Install units after above ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
- F. Cut tile to fit irregular grid and perimeter edge trim.

- END OF SECTION -

SECTION 09650
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.

1.02 RELATED SECTIONS

- A. Section 03301 - Concrete: Floor substrate surface.
- B. Section 09260 - Gypsum Board Systems: Wall materials to receive application of base.

1.03 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM F1066 - Vinyl Composition Floor Tile.
- C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.
- D. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

1.04 SUBMITTALS

- A. Submit under General Conditions.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 2 x 2 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Submit two 6 inch long samples of base material for each color specified.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/smoke rating requirements of materials in accordance with ASTM E84.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under General Conditions.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.08 MAINTENANCE DATA

- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

PART 2 PRODUCTS

2.01 MATERIALS - TILE FLOORING

- A. Vinyl Tile: FS SS-T-312 Type III
 - 1. Size: 12 x 12 inch
 - 2. Thickness: 1/8 inch
 - 3. Design: plain

2.02 MATERIALS - BASE

- A. Base: FS SS-W-40, Type I rubber top set coved premolded external corners:
 - 1. Height: 4 inch
 - 2. Thickness: 1/8 inch
 - 3. Length: 4 foot sections.
- B. Base Accessories: Premolded end stops and external corners, of same material, size, and color as base.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Flooring material.

- D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

3.03 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent when tile is placed.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- F. Install tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.
- G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- H. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- J. Install flooring in pan type floor access covers. Maintain floor pattern.

- K. At movable partitions install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, use 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

3.06 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on floor finish for 48 hours after installation.

- END OF SECTION -

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Surface preparation.
- B. Surface finish schedule.

1.02 REFERENCES

- A. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Laquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.

1.03 DEFINITIONS

- A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

1.04 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with three years experience.
- B. Applicator: Company specializing in commercial painting and finishing approved by product manufacturer.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

1.06 SUBMITTALS

- A. Submit product data under General Conditions.
- B. Provide product data on all finishing products.
- C. Submit samples under General Conditions.
- D. Submit two samples 4 x 6 inch in size illustrating range of colors available for each surface finishing product scheduled, for selection.
- E. Submit manufacturer's application instructions under General Conditions of this contract.

1.07 FIELD SAMPLES

- A. Provide samples under General Conditions.
- B. Provide two field sample panel, 6 inches long by 4 inches wide, illustrating coating color, texture, and finish.
- C. Accepted sample may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under General Conditions.
- B. Store and protect products under General Conditions.
- C. Deliver products to site in sealed and labelled containers; inspect to verify acceptance.
- D. Container labelling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
- E. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
- F. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA STOCK

- A. Provide a one gallon container of each color and surface texture to Owner.

- B. Label each container with color, texture, room locations, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - COATINGS

- A. Tnemec: Primers, Fillers and Coatings.
- B. Con-Lux: Primers, Fillers and Coatings.
- C. Porter: Primers, Fillers and Coatings.

2.02 MATERIALS

- A. Coatings: Ready mixed, except field catalysed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.03 FINISHES

- A. Refer to schedule at end of Section for surface finish and color schedule.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.
- D. Beginning of installation means acceptance of existing surfaces.

3.02 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect work of this Section.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- H. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- I. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- J. Interior Wood Items Scheduled to Receive Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- K. Metal Doors: Seal top and bottom edges with primer.

3.03 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.

- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceeding coat unless otherwise approved.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.
- G. Prime back surfaces of interior woodwork with primer paint.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Division 15 and Division 16 for schedule of color coding and identification banding of equipment, ductwork, piping, and conduit.
- B. Paint shop primed equipment.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- E. Replace identification markings on mechanical or electrical equipment when painted accidentally.
- F. Paint exposed conduit and electrical equipment occurring in finished areas.
- G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.06 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.07 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Exposed surfaces of steel lintels.

3.08 SCHEDULE - SURFACES

- A. Steel - Shop Primed
 - 1. Touch-up with zinc rich primer.
 - 2. Two coats epoxy semi-gloss.
- B. Wood - Painted
 - 1. One coat epoxy prime sealer.
 - 2. Two coats epoxy.
- C. Concrete, Concrete Block,
 - 1. One coat block filler.
 - 2. One coat primer sealer epoxy.
 - 3. Two coats epoxy, semi-gloss.
- D. Steel - Primed
 - 1. Touch-up with original primer.
 - 2. Two coats epoxy, semi-gloss.
- E. Gypsum Board
 - 1. One coat epoxy primer sealer.
 - 2. Two coats epoxy semi-gloss.
- F. Concrete Floor
 - 1. One coat primer, compatible with finish coat.
 - 2. Two coats chemical resistant epoxy.

- END OF SECTION -

SECTION 10165

PLASTIC LAMINATE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor mounted plastic laminate toilet partitions.
- B. Urinal screens.
- C. Shower cubicles.
- D. Attachment hardware.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 09260 - Gypsum Systems: Wall reinforcement plates for concealed in-wall construction.

1.03 RELATED SECTIONS

- A. Section - Wall reinforcement plates for concealed in-wall construction.
- B. Section 10800 - Toilet and Bath Accessories.

1.04 REFERENCES

- A. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. APA - American Plywood Association.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. NEMA LD-3 - High Pressure Decorative Laminates.
- E. ANSI 117.1 - Providing accessibility and usability for physically handicapped people.
- F. New Jersey Handicapped Code.

1.05 SUBMITTALS

- A. Submit shop drawings under provisions of General Conditions.
- B. Submit shop drawings indicating partition layout and dimensions, panel and door sizes, door swings, elevations, anchorage and mounting details, and finishes.
- C. Submit product data under General Conditions.

- D. Submit product data for components, hardware, and accessories.
- E. Submit samples under General Conditions.
- F. Submit two samples 3 x 6 inch in size illustrating panel colors and patterns.
- G. Provide a sample of each type of hardware.
- H. Submit manufacturer's installation instructions under provisions of General Conditions.

1.06 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 and state of New Jersey handicapped code for provisions for the physically handicapped.

1.07 FIELD MEASUREMENTS

- A. Verify field measurements are as shown on shop drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Santana Products Inc. Product Poly-mar MD.
- B. Substitutions: Under provisions of General Conditions.

2.02 MATERIALS

- A. Plastic Laminate Core: NEMA LD-3 solid laminate material.
- B. Headrail: 1 x 1-5/8 inch anodized extruded aluminum; with cast socket type wall brackets.
- C. Vanity Units: Vanities, backsplashes, sidesplashes etc.

2.03 ACCESSORIES

- A. Pilaster Shoe: ASTM A167, Type 304 stainless steel, 3 inch high with adjustable screw jack.
- B. Attachments, Screws, and Bolts: Stainless steel, theft proof type, heavy duty extruded aluminum brackets.
- C. Through Bolts and Nuts: Stainless steel with tamperproof heads.
- D. Steel Plate Reinforcement: Carbon steel, prepared for fasteners, 1/8 inch thick.
- E. Floor Base: Heavy-duty Terrazo.

2.04 HARDWARE

- A. Hinges: Non-ferrous cast pivot hinges, gravity type, adjustable for door close positioning, nylon bearings.
- B. Latch and Keeper: Thumb turn door latch, door strike and keeper with rubber bumper.
- C. Coat Hook: Cast alloy hook with rubber bumper tip.

2.05 FABRICATION

- A. Fabricate partitions by forming solid plastic laminate with finished faces and edges. Finish edges convex.
- B. Thickness of Partition Panels and Doors: One inch.
- C. Thickness of Pilasters: 1-1/4 inch.
- D. Thickness of Vanity Top: One inch.

2.06 FINISHES

- A. Plastic Laminate: finish color and pattern as selected.
- B. Stainless Steel Surfaces: No. 4 finish.
- C. Exposed Steel Surfaces: Polished Satin chrome plated.
- D. Aluminum: Anodized to as selected.
- E. Non-ferrous Surfaces: chrome plated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify correct location of built-in framing, anchorage, bracing, and plumbing fixtures.
- D. Beginning of installation means installer accepts existing conditions.

3.02 ERECTION

- A. Erect in accordance with manufacturer's instructions.
- B. Install partition components secure, plumb and level.
- C. Attach panel brackets securely to walls floors using appropriate anchor devices.

- D. Attach panels and pilasters to brackets with through bolts and nuts. Locate headrail joints at pilaster center line.
- E. Anchor urinal screen panels to walls with two panel brackets and to vertical pilaster anchored to floor and ceiling.
- F. Provide 1/2 inch space between wall surface and panels or pilasters.
- G. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- H. Equip each toilet stall door with top and bottom hinges, and door latch.
- I. Install door strike keeper on each pilaster in alignment with door latch.
- J. Equip each toilet stall door with one coat hook and bumper.

3.03 ADJUSTING

- A. Adjust and align door hardware to uniform clearance at vertical edges of doors. Clearance space not to exceed 3/16 inch.
- B. Adjust door hinges so that free movement is attained and will locate in-swinging doors in partial open position when unlatched.

3.04 CLEANING

- A. Remove protective coverings.
- B. Clean surfaces and hardware.

3.06 PROTECTION OF FINISHED WORK

- A. Field touch-up of finished surfaces will not be permitted. Replace damaged components.

- END OF SECTION -

SECTION 10210
METAL WALL LOUVERS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Louvers and frames.
- B. Bird Insect screening.

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

- A. Section 07900 - Joint Sealers: Perimeter sealants.

1.03 RELATED WORK

- A. Section 13121 - Pre-Engineered Building: Prepared exterior wall opening, exterior wall cladding and finish, supplementary framing for wall opening.
- B. Section 07900 - Joint Sealers.
- C. Section 09900 - Painting: Field painting.
- D. Section 15890 - Ductwork: Ductwork attachment to louver.

1.04 REFERENCES

- A. AMCA 500 - (Air Movement Council Association) Test Method for Louvers, Dampers, and Shutters.
- B. ANSI/ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- C. ASTM B209 - Aluminum-Alloy Sheet and Plate.

1.05 SYSTEM PERFORMANCE

- A. Fabricate louver to permit 50 percent free area.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of AMCA certified louvers with three years experience.

1.07 SUBMITTALS

- A. Submit shop drawings under General Conditions.
- B. Indicate on shop drawings, layout, elevations, dimensions, and tolerances; head, jamb, and sill details; blade configuration; screening; and frames.

- C. Provide product data on preassembled louvers describing design characteristics, maximum recommended air velocity, free area, materials, and finishes.

1.08 COORDINATION

- A. Coordinate work of this Section with installation of metal siding.
- B. Coordinate work of this Section with mechanical ductwork.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Construction Specialties.
- B. Substitutions: Under provisions of General Conditions.

2.02 MATERIALS

- A. Aluminum: ANSI/ASTM B221, alloy, temper; extruded shape, prefinished with mill applied modified silicone paint finish.
- B. Fasteners and Anchors: Galvanized Stainless steel type.

2.03 ACCESSORIES

- A. Bird Screen: Interwoven wire mesh of aluminum; 0.063 inch diameter wire, 1/2 inch open weave, diagonal design.
- B. Insect Screen: 18 x 16 size aluminum mesh, set in aluminum frame.

2.04 FABRICATION

- A. Louver Size: 4 inches deep, face measurements as indicated.
- B. Louver Blade: Sloped at 45 degree; minimum material thickness of 18 gage integral waterstops on blade.
- C. Louver Frame: Channel shape, welded corner joints, material thickness of 18 gage.
- D. Mullions: Concealed aluminum, profiled to suit louver frame.
- E. Screens: Permanently install screen mesh in shaped frame with reinforced corner construction; screw to louver frame.

2.05 FINISHES

- A. Exterior Aluminum Surfaces, Screens Prepainted finish of Kynar 500 finish, color as selected.

- B. Interior Aluminum Surfaces, Screens, and Blank Out Sheeting:
Finish as selected.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Secure louvers in opening framing with concealed fasteners removable for maintenance purposes.
- D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Install bird and insect screening to exterior of louver. Hinge screens for access.
- F. Install insect screens to intake louvers. Install bird screens to exhaust louvers.
- G. Install perimeter sealant in accordance with Section 07900.

- END OF SECTION -

SECTION 10441

PLASTIC SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Engraved plastic signs.
- B. Equal.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with General Conditions.
- B. Submit shop drawings listing sign styles, lettering and locations, and overall dimensions of each engraved sign. The Contractor shall specify the sizes of the signs; the location and application of the sign will influence the size.
- C. Submit manufacturer's installation instructions under General Conditions.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products.
- B. Store adhesive tape at ambient room temperatures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Engraved Signs: Solid color acrylic plastic 0.125 inch thick; 3 inches high; square edges; engraved letters with contrasting color inset. Characters formed to Helvetica style.
- B. Mass produced signs shall be used where possible. Signs shall be corrosion resistant and weatherproof.
- C. Face Color: Red.
- D. Core Color: White.

2.02 LETTERING

- A. Size and Style: 1-1/2 inch high upper case Helvetica.

2.03 ACCESSORIES

- A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Perimeter warning signs shall be securely fastened to the fence at locations specified by the Contractor and approved by the Engineer.
- C. Install signs after doors are finished, in locations scheduled.
- D. Center sign on door level.
- E. Clean and polish.

3.03 SCHEDULES

A. Perimeter Warning Signs:

A sign with the legend, "Danger - Unauthorized Personnel Keep Out" must be posted at each gate and at 100 foot intervals along the chain link fence on the landfill perimeter.

B. Door Signs.

Door No.

1	Electric Control
2	Danger Gas - No Smoking
3	Danger Gas - No Smoking
4	Danger Gas - No Smoking

C. Confined Space Warning Signs:

A sign with the legend, "Warning - Confined Space" must be posted at all valve vaults intended for entry.

D. Gas Building, Gas Collection Facilities Warning Signs: Signs with the legends, "No Smoking - Open Gas Flame", "Danger - Open Gas Flame" must be posted in and around the gas building and gas collection facilities.

- END OF SECTION -

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Cabinets.
- C. Accessories.

1.02 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Wood blocking and shims.
- B. Section 09900 - Painting: Field paint finish.

1.03 REFERENCES

- A. ANSI/NFPA 10 - Portable Fire Extinguishers.
- B. ANSI/UL 92 - Fire Extinguisher and Booster Hose.
- C. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.
- D. UL 8 - Foam Fire Extinguishers.
- E. UL 154 - Carbon Dioxide Fire Extinguishers.
- F. UL 299 - Dry Chemical Fire Extinguishers.
- G. UL 626 - 2 1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.
- H. UL 1093 - Halogenated Agent Fire Extinguishers.

1.04 SUBMITTALS

- A. Submit under provisions of General Conditions.
- B. Shop Drawings: Indicate cabinet physical dimensions, wall bracket mounted measurements, location, and style.
- C. Product Data: Provide extinguisher operational features, color and finish, anchorage details and type.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of General Conditions.
- B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 QUALITY ASSURANCE

- A. Provide units conforming with ANSI/UL 711.
- B. Maintain one copy of document on site.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements for extinguishers.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. J.L. Industries Product Cosmic 20E.
- B. Larsen Product MP20.
- C. Substitutions: Under provisions of General Conditions.

2.02 EXTINGUISHERS

- A. Dry Chemical Type: UL 299, Stainless steel tank, with pressure gage; size and classification as scheduled.

2.03 CABINETS

- A. Metal: Formed stainless steel; 18 gage thick base metal.
- B. Configuration: Surface type, sized to accommodate accessories.
- C. Trim Type: Flat, 1" wide face.
- D. Door: 18 gage thick, reinforced for flatness and rigidity; latch access.
- E. Door Glazing: Plastic, clear, 1/8 inch thick polycarbonate.
- F. Cabinet Mounting Hardware: Appropriate to cabinet.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chromed finish.

2.05 FABRICATION

- A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- B. Pre-drill for anchors.
- C. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.
- D. Weld, fill, and grind components smooth.
- E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

- A. Extinguisher: Steel, enamel to color as selected.
- B. Cabinet Exterior Trim and Door: Red baked enamel, color as selected.
- C. Cabinet Interior: White enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level on wall 30 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

3.02 SCHEDULES

- A. All fire extinguishers shall be multi-purpose dry chemical with UL rating 20A - 120 B:C placed in locations as shown on drawings.

- END OF SECTION -

SECTION 10800
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Toilet and shower accessories.
- B. Attachment hardware.
- C. Lockers.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 09260 - Gypsum Board Systems: Installation of backing plate reinforcement.

1.03 RELATED SECTIONS

- A. Section 09260 - Gypsum Board Systems: In wall framing and plates for support of accessories.
- B. Section 10165 - Plastic Laminate Toilet Carpartments.

1.04 REFERENCES

- A. ANSI/ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
- B. ANSI/ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- C. ANSI/ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
- D. ANSI/ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- F. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- G. NEMA LD-3 - High Pressure Decorative Laminates.

1.05 SUBMITTALS

- A. Submit product data under General Conditions.

- B. Provide product data on accessories describing size, finish, details of function, attachment methods.
- C. Submit two samples of each component illustrating color and finish.
- D. Submit manufacturer's installation instructions under General Conditions.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bobrick: bathroom fixtures.
- B. Medart: lockers.
- C. Substitutions: Under provisions of General Conditions.

2.02 MATERIALS

- A. Sheet Steel: ANSI/ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Plastic Laminate: NEMA LD-3, general purpose type; 0.125 inch thick, pattern, as selected.
- E. Adhesive: Contact type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamperproof.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

- E. Shop assemble components and package complete with anchors and fittings.
- F. Provide steel anchor plates, adapters, and anchor components for installation.
- G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.

2.04 FACTORY FINISHING

- A. Galvanizing: ANSI/ASTM A123 to 1.25 oz/sq ft.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ANSI/ASTM B456, Type SC 2 satin finish.
- E. Stainless Steel: No. 4 satin luster finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

3.03 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.04 SCHEDULE

- A. Toilet Paper Dispenser - quantity (2)
- B. Sanitary Napkin Disposal - quantity (2)
- C. Soap Dispenser - quantity (2)
- D. Paper Towel Dispenser - quantity (2)
- E. 24 x 36" Mirror - quantity (2)
- F. Towel Bar - quantity (2)
- G. Soap Dish - quantity (2)
- H. Clothes Hooks - quantity (6)
- I. Lockers - quantity (8) size 12' x 18" x 36"
- J. Shower Curtain - quantity (4)
- K. Garbage Can - quantity (2)

- END OF SECTION -